RADIO CRAFT

PUBLISHED

HUGO GERNSBACK, *Editor*

CHICAGO PARTS SHOW NUMBER

NOTRON
E TESTS
PAGE 22

In this issue—

An Economy Transmitter

Quick A. C.-D. C. Repairs

R. F. Power Supplies

MAY
194

25
CANADA

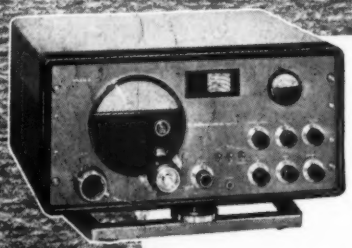
RADIO-ELECTRONICS IN ALL ITS PHASES

Going places (AGAIN)

hallicrafters

Hallicrafters famous radio equipment, sold and distributed around the world before the war and used with superb effectiveness in every theater during the war is once again on the move. Watch for latest details of the Gatti-Hallicrafters mobile radio equipped expedition to the Mountains of the Moon in deepest Africa—a new and exciting test for the ingenuity of hams and the performance of Hallicrafters equipment.

3 GREAT RECEIVERS designed and priced for hams who are going places, too

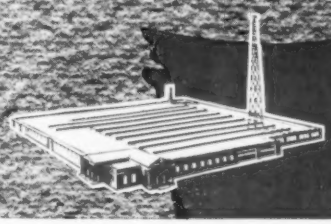


Model **SX-42** Described by hams who have operated it as "the first real postwar receiver." One of the finest CW receivers yet developed. Greatest continuous frequency coverage of any communications receiver—from 540 kc to 110 Mc, in six bands. FM-AM-CW. 15 tubes. Matching speakers available. **$275.00**

Model **S-40A** Function, beauty, unusual radio performance and reasonable price are all combined in this fine receiver. Overall frequency range from 540 kc to 43 Mc, in four bands. Nine tubes. Built-in dynamic speaker. Many circuit refinements never before available in medium price class. **$89.50**

Model **S-38** Overall frequency range from 540 kc to 32 Mc, in four bands. Self contained speaker. Compact and rugged, high performance at a low price. Makes an ideal standby receiver for hams. CW pitch control is adjustable from front panel. Automatic noise limiter..... **$47.50**

Prices slightly higher in zone 2



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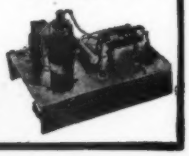
You build the SUPERHETERODYNE CIRCUIT above containing a preselector oscillator-mixer-first detector, i.f. stage, diode-detector-a.v.c. stage and audio stage. It will bring in local and distant stations. Get the thrill of learning at home evenings in spare time while you put the set through fascinating tests!

Building the A. M. SIGNAL GENERATOR at right will give you valuable experience. Provides amplitude-modulated signals for test and experimental purposes.



The men at the right are just a few of many I have trained, at home in their spare time, to be Radio Technicians. They are now operating their own successful spare-time or full-time Radio businesses. Hundreds of other men I trained hold good jobs in practically every branch of Radio. Doesn't this PROVE my "50-50 method" of home training can give you BOTH a thorough knowledge of Radio principles and the PRACTICAL experience you need to help you make more money in the fast-growing Radio industry?

Many Beginners Soon Make Extra Money in Spare Time While Learning

The day you enroll I start sending EXTRA MONEY JOB SHEETS. You LEARN Radio principles from my easy-to-understand, illustrated lessons—PRACTICE what you learn by building, testing and experimenting with parts I send—USE your knowledge to make EXTRA money fixing neighbors' Radios in spare time while still learning! From here it's a short step to your own full-time Radio Shop or a good Radio job!

VETERANS

You can get this training right in your own home under G. I. Bill. Mail coupon for full details.

Future for Trained Men is Bright in Radio, Television, Electronics

It's probably easier to get started in Radio now than ever before, because the Radio Repair Business is booming. Trained Radio Technicians also find profitable opportunities in Police, Aviation, Marine Radio, Broadcasting, Radio Manufacturing, Public Address work. Think of even greater opportunities as Television, FM, and many new, war-developed Electronic devices become available to the public! Soon, there will be more Radio equipment to install, operate, maintain and repair than ever before in all history! Get the facts on all these opportunities. Send for FREE books now!

Find Out What NRI Can Do For You

Mail Coupon for Sample Lesson, "Getting Acquainted with Receiver Servicing," and my FREE 64-page book. It's packed with facts about Radio's opportunities for you. Read the details about my Course. Read letters from men I trained, telling what they are doing, earning. See how quickly, easily you can get started. No obligation! Just MAIL COUPON NOW in an envelope or paste it on a penny postal. J. E. SMITH, President, Dept. 7EX, National Radio Institute, *Pioneer Home Study Radio School*, Washington 9, D. C.

I Trained These Men — SPARE TIME RADIO BUSINESS

MINISTER MAKES $10-$20 WEEKLY, SPARE TIME
"I am a minister. I am in a county seat new trying to serve the people in my church, also trying to keep their Radios playing. I have been making from $10 to $20 per week in spare time."—E. SMITH, Benton, Tenn.

DOING GOOD SPARE TIME BUSINESS
"I have been getting receivers to repair right along lately, and by using the methods taught me in the NRI Course, I don't have to spend much time on any of them."—STANLEY N. STRICKLAND, 193 Dale Homes, Portsmouth, Va.

MADE $612, IN 12 MONTHS, SPARE TIME
"Soon after I finished my experimental kits lessons I finished my Course and got my service job. I tackled my first Radio jobs I could handle in my own home. I made $612 in spare time the past 12 months in spare time."—W. CLARK, Wilmington, N. C.

I Trained These Men — FULL TIME RADIO BUSINESS

FULL TIME JOB BEFORE FINISHING COURSE
"After completing about two-thirds of my Course I entered a Radio Repair shop. Later I opened a branch and for myself and much pleased with the work being my first year of business."—A. N. AYERS, Washington 10, D. C.

MADE $1500 WHILE LEARNING
"By the time I finished my NRI training I had made $1500. When I started the Course I did not know a resistor from a condenser. I have bought my home. My income from Radio work, etc., is about $3,000 a year."—WILLIAM THOMAS, Baldwyn, Miss.

AVERAGES BETTER THAN $3,000 A YEAR
"I now have a shop and am doing fine. I average better than $3,000 per year, and certainly NRI much of the credit."—RAYMOND F. DAVIS, Ashburn, Ga.

SAMPLE LESSON FREE

I will send you a FREE Lesson, "Getting Acquainted with Receiver Servicing," to show you how practical it is to train for Radio at home in spare time. It's a valuable lesson. Study it—keep it—use it—without obligation! Tells how Superheterodyne Circuits work, gives hints on Receiver Servicing, Locating Defects, Repair of Loudspeaker, I. F. Transformer, Gang Tuning, Condenser, etc., 31 illustrations.

My Radio Course Includes
TELEVISION • ELECTRONICS
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Transmits only when spoken to at close range

A new Turner development . . . Now factories, machine shops, engine rooms, trains, aircraft, etc., can have sharp, clear communications. Turner engineers have solved the problem of effective speech transmission under adverse noise conditions. The Turner Model 15D-NC is so expertly designed and balanced it amplifies only sound originating close to its specially engineered diaphragm. Random sound (noise) arriving from a distance strikes both sides of the diaphragm simultaneously and is canceled out. This new microphone transmits only when spoken to at close range from the front.

The LOUDER the noise—the BETTER the results

By speaking directly into the front side of the Turner Model 15D-NC clear cut results are achieved at ordinary levels of conversation. The din, clatter, and clang of machinery and other disturbances are canceled out. In fact, the higher the noise level, the more effective will be the results observed.

Designed for Convenience

The Model 15D-NC is a rugged dynamic built to stand severe operating conditions. It is housed in an attractive hand held case of light, tough alloy. When not in use, it may be hung on a hook. If desired, a "push-to-talk" thumb switch is built into the handle for on-off operation or relay work. Available in 50, 200, 500 ohms, or high impedance.

SPECIFICATIONS Turner Model 15D-NC

EFFECTIVE OUTPUT LEVEL; 56 db below 1 volt/dyne/sq cm.

FREQUENCY RESPONSE: 50 to 5000 c. p. s.

OUTPUT IMPEDANCE: 50, 200, 500 ohms, or high impedance.

DIRECTIONAL CHARACTERISTICS: Close talking only.

DIAPHRAGM: High quality corrosive resistant aluminum.

MAGNETIC CIRCUIT: High energy magnetic circuit with moving voice coil. Both sides of diaphram exposed to balance out random sound.

CASE: Smooth, die cast alloy.

FINISH: Gray gunmetal enamel.

MOUNTING: Hand held. Hole provided at top of case for hanging on hook.

CABLE: 7 foot attached, single conductor, shielded.

DIMENSIONS: 7" long x 2⅜" wide x 1½" deep.

WEIGHT: Approximately 24 ounces.

OPTIONAL: "Push-to-talk" thumb switch for on-off or relay operation.

Also available as Model 15D semi-directional dynamic without noise canceling feature. Level: 56 db below 1 volt/dyne/sq cm. Response: 40 to 7500 c. p. s.

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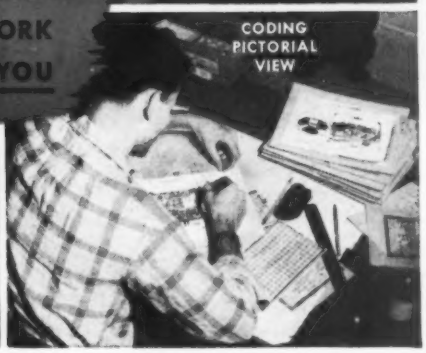

COMPLETE

Everything you need in one handy, unified form—large schematics, pictorials keyed to parts lists and alignment data, complete listings of parts values and replacements, alignment, stage gain, circuit voltage and resistance analysis, *coil resistances*, dial cord stringing, disassembly instructions, record changer analysis and repair.

ACCURATE

All sets are taken apart and analyzed by experts in the Sams laboratories. Every part is measured, tested and triple-checked for accuracy. All data is original. This means the data you get is *right*.

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PHOTOFACT FOLDERS are issued twice monthly as the new receivers come off production lines. You don't have to wait for information. As receiver changes are made, you get correction and addition sheets for your files. Your data is always up to the minute.

EASY TO USE

All diagrams and pictures are coded to numbered parts lists. Everything is positively identified for fast work. All folders are set up in uniform, easy-to-follow style: big type, big illustrations —no hunting, guessing or eye strain —no more loss of time and temper.

$403,531.05†—that's what it actually cost us to create, print and distribute Volume 1 of Sams PHOTOFACT FOLDERS. Every penny of that money has been spent to bring the industry the most accurate, complete, up-to-the-minute data ever produced for radio servicemen. And this continuing service, designed to help you make up to *twice as many repairs daily*, actually costs you less than 9 cents a day.

PHOTOFACT FOLDERS could not be produced without the support of America's leading replacement parts manufacturers—without the support, too, of thousands of enthusiastic PHOTOFACT subscribers. With their cooperation, we will continue to place in your hands ALL the information you need to do a better job—facts, figures, photographs, full-page schematics—*information compiled from actual first-hand analysis of all new instruments.* PHOTOFACT FOLDERS cover *all* radios, phonographs, record changers, recorders, communications systems and power amplifiers—*and are timed to reach you as these instruments are released.* The cost is only $1.50 per set of 30 to 50 folders and includes membership in the Howard W. Sams Institute.

Set No. 17 will be ready for mailing April 10th. Set No. 18 on April 25th. Sets Nos. 11 to 16 inclusive, also priced at $1.50 each, are available for immediate order.

Start using PHOTOFACTS to make more profits. Remember, PHOTOFACT FOLDERS actually cost you nothing: *they pay for themselves over and over!* See your replacement parts distributor—or write us direct. In Canada, address A. C. Simmonds & Sons, 301 King Street East, Toronto, Ontario. Canadian price, $1.75.

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SYLVANIA NEWS
RADIO SERVICE EDITION

MAY *Prepared by* SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 1947

BRAND NEW SYLVANIA TECHNICAL MANUAL NOW AVAILABLE TO RADIO SERVICEMEN!

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Here's the new, handy volume of valuable radio tube information radio servicemen everywhere have been waiting for. This bigger, better-than-ever latest Sylvania Technical Manual—listing over 500 radio tube types (old and new)—has been made available as a result of the solution of extensive and elaborate tube engineering problems.

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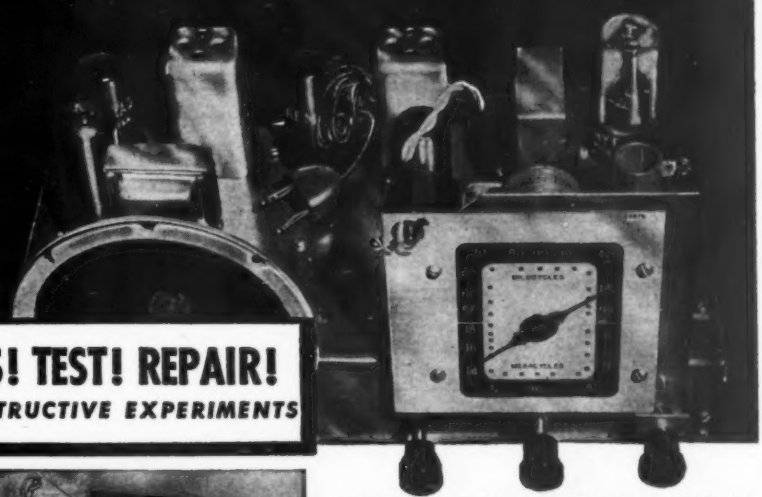
I SEND YOU 8 BIG KITS OF RADIO PARTS

Including a **COMPLETE 6 TUBE SUPER-HETERODYNE RECEIVER**

I TRAIN YOU RIGHT by PUTTING YOU TO WORK with REAL PROFESSIONAL EQUIPMENT!



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You'll get valuable experience and practice building this Signal Generator and multi-purpose Tester. Makes a breeze out of fixing Radios and you don't have to spend money on outside, ready-made equipment.

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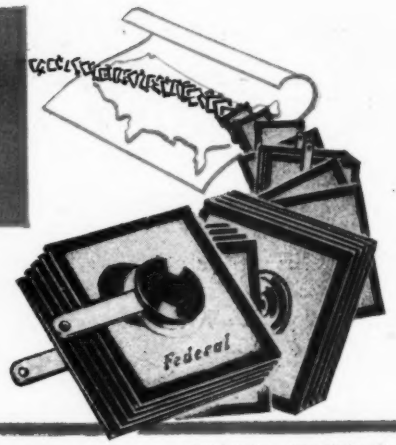

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Salt Lake City—S. R. Ross

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Burlington—Vermont Hardware Co.
Rutland—Rutland Radio Center

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Norfolk—Radio Parts Distributing Co.
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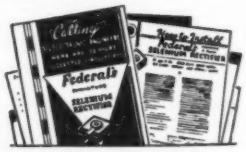

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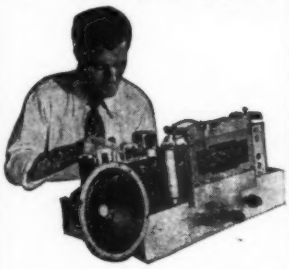

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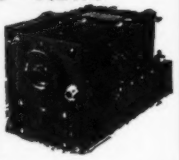

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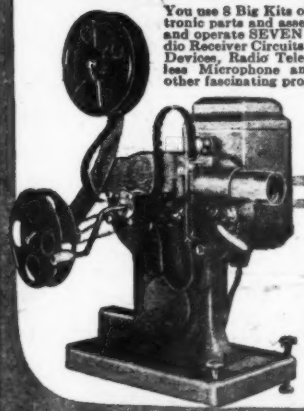

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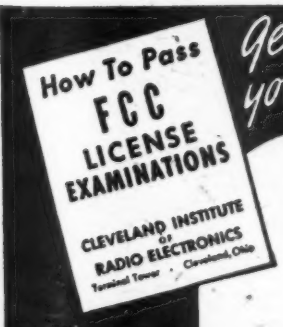

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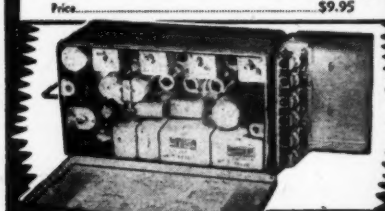
ESSE Specials!

C-1 AUTO PILOT AMPLIFIER

Used to control the operation of the Servo Units causing them to move the control surfaces of the airplane in one direction or the other in response to the signals received. The complete amp. includes one rect. 7Y4, three 7F7's for amplification and control, three 7N7's for signal discrimination, one power transformer, six relays, four control pots, chokes, condensers etc. Convert for use on radio controlled models, doors etc. Operates from 24 V. DC. Size 9¼"x6¼"x7⅝". Complete with tubes as described.

Price.....$9.95



R-89/ ARN 5A GLIDE PATH RECEIVER

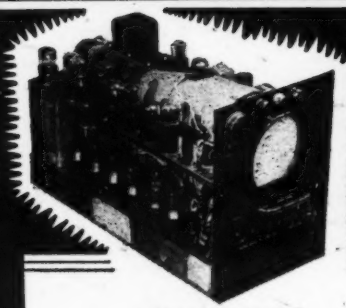
Formerly used for blind landing but adaptable to many other uses such as receiver for new police or citizen's band. Band of operation 326-335 mc. on any of three pre-determined crystal controlled frequencies. Contains eleven tubes, 6 relays and other valuable parts. For 24 V. DC operation. Size 13¾"x5¼"x6⅝"

Price, complete as shown.....$12.45

LOCALIZER RECEIVER BC-733-D

A part of aircraft blind landing equipment manufactured by WE. Operates on any six of its predetermined crystal controlled frequencies in the range of 108-120 mc. Contains 10 tubes, three of which are WE 717-A's — and crystals. Ideal receiver for conversion to 144 mc. ham band or mobile telephone bands. For 24 V. DC operation. Size 14½"x7"x4⅝". Complete with tubes.

Price, complete with dynamotor.....$12.45



APN-4 RADAR SCOPE

Ideal for conversion to service scope or salvage for parts. Contains 27 tubes such as 6SN7GT, 6H6GT, 6SL7GT, 6SJ7GT and 5CP1 scope tube. 22 pots, switches, condensers, transformers etc. In aluminum case, approx. size 9"x12"x18".

Price.....$17.95 ea.

SOLD OUT

AIRCRAFT RADIO RANGE FILTER FL-8-A

For helpful reduction of QRM on crowded CW bands. When attached to output of any communications receiver:

1 — Will pass signal of 1020 CPS, eliminating others.

2 — Will pass voice frequencies and eliminate 1020 CPS code signal.

Compact, light weight, with switch. Size 2¾"x2⅛"x3¾".

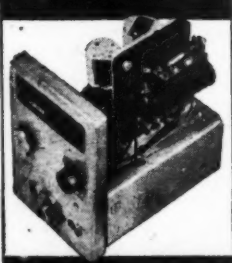
Price.....$2.25 ea.

Unless otherwise noted this merchandise was removed from surplus aircraft and is sold as used.

MARKER BEACON RECEIVER

Ideal for controlling remote circuits for model aircraft, boats, etc. Operates from 75 mc. Signal easily altered to 2 meter band. Tubes used and included: 1—6SH7, 1—6SL7GT, 1—12SN7GT. Also sensitive relay. Circuit diagram included inside case. Size 5⅝"x3⅜"x 5¼". For 24 V. DC operation. Complete as shown.

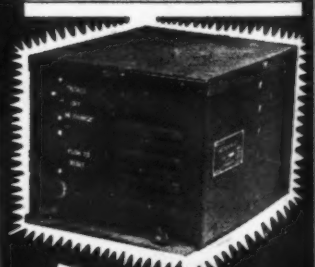
Price.....$3.95



RECTIFIER UNIT RA-63-A

Charges 12V. batteries at 5 amp. rate hi charge or 2 amp. trickle. Easily converted to use as 6V. charger or battery eliminator for auto radio servicing in your shop. Sturdily built dry plate rectifier protected by overload circuit breaker. These units removed from famous SCR-299. Used but in good condition.

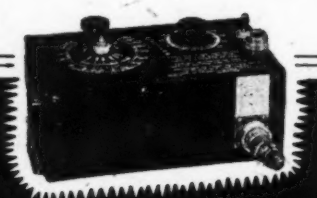
Price.....$14.85 ea.



INTERVALOMETER

Electronic timing device for releasing bombs at preset intervals. Ideal for dark room timer, model train controller e.t.c. Contains relays, switches, pilot light, resistors, knobs, etc. Approximate weight, 7 lbs.

Price.....$3.95 ea



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ESSE Radio Company

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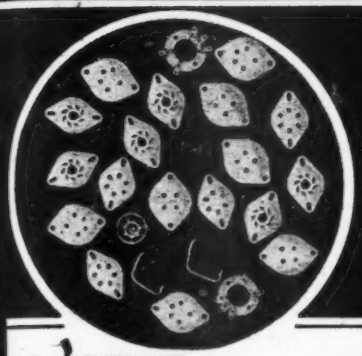
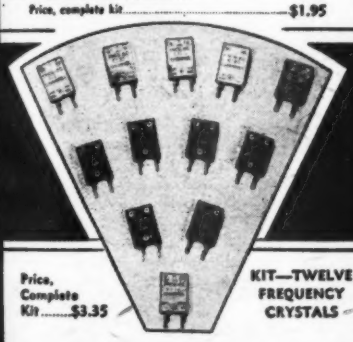
ESSE Specials!



KIT — 24 TUBE SOCKETS

Containing the following new Ceramic lo-loss sockets: 2-Acorn, 6 octal Amphenol, 4-6 prong Millen, 4-5 prong wafer, 4-4 prong wafer, 2 molded bakelite, 2 octal female plugs and 2-7 prong tube tester sockets with center socket for checking pilot lamps.

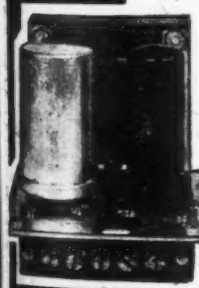
Price, complete kit.....$1.95



Price, Complete Kit.....$3.35

KIT—TWELVE FREQUENCY CRYSTALS

Contains assorted frequencies between 3,000 Kc. and 8,000 Kc. in FT 243 crystal holders. We pick at random from mixed supply and cannot select frequencies.



BC-348 POWER SUPPLY

To convert the BC-348 receiver for 110 V. AC operation. Constructed especially for the Esse Radio Company by a leading transformer company.

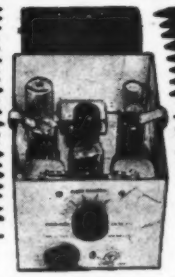
These power supplies have gained great popularity due to quality, price and simplicity in conversion. Filament supply 24V. Rectifier tube used: 6x5 (not included).

Price.....$8.95 ea.

MC ELROY CODE EQUIPMENT BRAND NEW

A proud addition to any Ham Shack. Use it to ink paper tape for high speed sending or receiving, or convert to other uses. Original price several times this low price. Shipped as shown in individual wood carrying case. Tubes used: 1-1117Z6; 2-1179?—not included.

Price for both.....New.....$50.00
Used.....$35.00



INTERPHONE AMPLIFIER AM-26/AIC

Convert to high fidelity phone amp. or speech amp. Case size 9¾"x4¼"x5½". Tubes used and included: 2—12SJ5GT, 2—12A6. Complete with dynamotor as shown, for 24 V. DC. operation.

Price.....$4.85 ea.

On orders less than $10.00 allow additional charge of 25c to cover handling

SIGNAL CORPS TIME INTERVAL UNIT ML-138

This unit is housed in a sturdy metal case, 7½"x6"x5¼" with hinged top. Includes necessary adjustment tools. Powerful clock mechanism runs several days. Audio Tone, controlled by relay, is emitted for several seconds once every few minutes. Two flashlight cells needed. Has many possibilities for Radio-men or Model Makers. Parts alone are worth more than our price.

Price.....$4.95 ea.

RADIO ALTIMETER APN/1

A complete 460 mc. radio receiver and transmitter which can be converted for ham or commercial use. Tubes used and included: 4-12SH7, 3-12SJ7, 2-6H6, 1-VR150, 2-955, 2-9004. Other components such as relays, 24V. dynamotor, transformers, pots, condensers, etc. make this a buy on which you can not go wrong. Complete as shown in aluminum case 18"x7"x7½".

Price.....$14.95

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ESSE Radio Company

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SCR-625 MINE DETECTOR — BRAND NEW
Metallic Objects Only

Used by the Army to detect buried metallic mines. Its private use suggests the location of underground or underwater pipes, cables and ore bearing rock, the location of metallic fragments in scrap materials, logs, etc. and the screening of personnel in plants for carrying of metallic objects.

The unit consists of a balanced inductance bridge, a two-tube amp. and a 1,000 cycle oscillator. The presence of metal disturbs the bridge balance, resulting in a volume change of the 1,000 cycle tone. The tubes used are low battery drain types such as 1G6 and 1N5. The circuit may be modified for control of warning signals, stopping of machinery etc. when metal is detected. Operates from two flash light batteries and 103 V. "B". However, a power supply operating from 110 V. may be used. Comes complete with spare tubes, spare resonater and instruction manual — in wooden chest 8¼"x28¼"x16". Weight in operation is 15 lbs. New, complete in original overseas packing container. Originally sold by War Assets for $166.00.

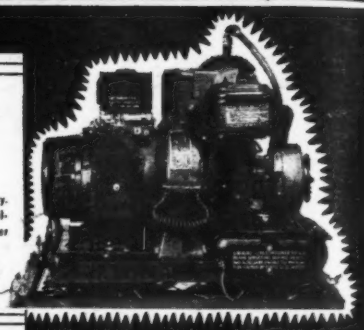
The U. S. Forestry Service has recommended procedure for using the SCR-625 Mine Detector to find concealed metal in tree logs and other timber products.

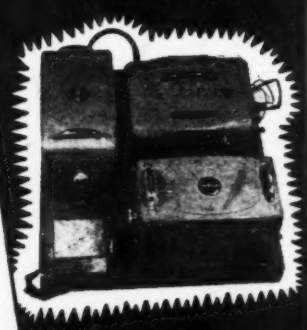
Price ..... $79.50 ea.

GASOLINE GENERATOR—
27.5 V. DC — 70 AMP.

Electrical starting when connected to 24 V. battery. Ideal for power for emergency, cabins, aircraft, welding etc. These units were used for auxiliary power on bombers.

Price (used) $72.50





MOTOROLA POLICE TRANSMITTER AND RECEIVER—AM

An ideal unit to convert from its original 9 meter freq. to the 10 meter amateur band for mobile work. Complete with antenna relay, high voltage vibrator supply for both receiver and transmitter and most all tubes. These units were used by Army Military Police and are sold as received. Condition is good except for occasional missing tubes.

Price. Complete as shown (used) .. $65.00

LINK FM POLICE TRANSMITTER AND RECEIVER (Not Shown)

Received in same purchase as above equipment. For 27-38 mc. operation. Complete ready to operate.

Price per set (used) $65.00

MINE DETECTOR AN/PRS-1
BRAND NEW

For detection of metallic and non-metallic objects. Used to locate buried pipe, cables, sewer tile etc. The unit is a UHF transmitter and indicates objects by deflection of the microammeter either to left or right depending upon whether metallic or non-metallic. Audio indication is also given by a change in volume of 1,000 cycle tone. Ready to operate with addition of 1-6 V. and 3-45 V. batteries. Comes complete with spare tubes, antennae, reflectors and instruction book — in wooden chest 9½"x 28¼"x15½". Weight, in operation 22 lbs. Shipped new in original overseas moisture proof container.

Price ..... $14.95 ea.

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SWAP—BUY OR SELL

FOR SALE—National SW-3 short wave receiver with power supply, three sets band spread coils for 20, 40, 80 meter bands, one general coil for 20 meters. Good condition, $20 as is. George Kershenbaum, 1100 Albany Ave., Hartford 5, Conn.

FOR SALE — RME-69 with re-aligned speaker, $95.00 F.O.B. Radio W4IW, Lykesland, S. C.

FOR SALE—Hallicrafters S-20-R in good condition. R.F. and I.F. stages "souped-up" with hi-gain tubes. Want to buy SX-28A. A. J. Elsen, 419 Thurston, Ithaca, N. Y.

FOR SALE—Teirad 18-A standard frequency. Brand new in original carton with extra tubes, $20. Samuel Strauss, 94-06 34th Road, Flushing, N. Y.

FOR SALE—2-meter Transmitter-receiver, "7193" osc., 20 watts, 955 Receiver 6C5-6L6, common audio. Switch for fixed or mobile. Black crackle case. Meter, 2" p.m. speaker; plus power supply, $45. J. R. Lowe, 1230 2/3 North Flores St., Hollywood, Calif.

FOR SALE—Hallicrafters SX-32 receiver and speaker. Masco 35-watt amplifier and Turner 33X mike. Thordarson TSM22 modulation transformer; Thordarson 1000V d-c power supply; Kenyon 1000V d-c power supply; Millen Xtal control exciter with coils for all bands. M. W. Shellhamer, 224 Pitt St., Tamaqua, Pa.

FOR SALE—New RC-375 transmitter, 20 to 160 meters converted for 110V, a-c operation with a-c power supply. Complete with tubes, key, mike and tuning units. Less a-c power supply. Arthur Buck, 413 N. Second St., Wormleysburg, Pa.

FOR SALE—Brand new, McMurdo Silver Model 900 Vomax, $49; Model 905 Sparx, $34; Model 904 Bridge, $44. All three to one person for $125. S. R. Bernstein, 349 19th St., Brooklyn, N. Y.

FOR SALE—New Abbott TR-4 transmitter and receiver; new Abbott DR-3 portable transceiver complete; Instructograph with ten new tapes and oscillator. Want S-19-R or Howard 430 in good working condition. Wm. H. Lorimer, P.O. Box 361, Williamsport, Pa.

FOR SALE—Hallicrafters receiver SX-32 modified with SX-28A panel and new cabinet. John Lim, P.O. Box 2307, San Francisco, Calif.

FOR SALE—American code reader with 110V, 60cy. motor, key attachment with 12 learner's tapes. 3-tri-signal beginner's units, earphones. TU7B, TU8B tuner units. QST's 1923 to date. H. E. Leigh, Sr., 197 N. 14th, San Jose, Calif.

FOR SALE—Gardner model "S" code sender; Speedex key; BP4 cathode ray tube with socket and leads. Supreme multi-meter. Write for information on other equipment. Edwin W. Ozellus, 977 Warren Ave., Brockton, Mass.

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Type 68P Capacitors . . . Ranges from .001 mfd. 400V to 0.5 mfd. 100V.

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Look to Sprague for the newest—and the best!

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FOR SALE—Hallicrafters Sky Ranger S-39 in good condition, $70. Robert Goron, Montecello Hotel, Boulder, Colo.

FOR SALE—Webster phono with model 50 changer, plays up to 12 records, fast changing, 8" speaker, 3-tube amplifier, leatherette cabinet, 24" x 17". Bargain at $65 complete. David Ehart, 2219 Sunset Ave., Utica 4, N. Y.

WANTED—Solar CE or VTVM. Have new Superior signal generator for trade. Larson, 14 E. 30th St., New York 16, N. Y.

FOR SALE — New Precision 200 signal tracer, $25; Simpson 315 signal generator new, $66; Simpson 260 Volt-ohmmeter, $35; New Precision set tester; Used equipment; 535 Simpson 'scope, $30; RCA 156 Tube Tester, $35. Hamilton Radio Clinic. What Cheer, Iowa.

SELL OR SWAP—Western Electric sig. generator, 50-100 MC $35; Sola voltage reg. transformer, 300 watt, $20, 500 watt, $35. G. E. 6V battery charger, 1 to 12 batteries, $45; QST's 1927-1932; IRE's 1927-1937. A. J. Gerel, 278 E. Columbia St., Hempstead, N. Y.

FOR SALE—Supreme 400B Diagnometer in case, A-C cord missing, otherwise complete; 3 fine Jewell meters A-C, D-C, Ma. Radionic Engineering Co., 620 North and South Rd., University City 5, Mo.

SELL OR SWAP—Transmitter, receiver 2-8 mc; 235 mc transceiver, same cabinet; VFO phone/cw/mcw 25 watts; headphones; mike; variometer; intercoms; antennas; co-axes; dynamotor. Robert Bonuck, 35-63 88th St., Jackson Heights, L. I., N. Y.

FOR SALE—Fellers sig. tracing analyzer TS-2, slightly used, good as new, $25; Chicago Instrument VOM 371, new $2.50; Meissner 3-tube midget radio, wired, complete with tubes and 5 coils, $10; Hallicrafters S-28 receiver, $45. Garland Bowman, Star Route, Rockymount, Va.

WANTED—Used sig. generator in good condition; condenser tester (cap. resistor bridge). Pay cash or trade. What do you need? Your Radio Doctor, 397 Melrose St., Brooklyn, N. Y.

WANTED—Instruction manual, wiring diagrams, parts list, other data pertaining to Hickok tube tester 51X. James W. Hoskins, 212 Middlefield Rd., Palo Alto, Calif.

FOR SALE—Motorola portable radio 41D, good condition, uses 1H5, 1N5, 1A7, 1Q5 tubes, $20; good P.A. and instrument amplifier 15 watt; and Turner 3X mike, $50. J. E. Decker, Chattanooga, Okla.

WANTED—One original Nathaniel Baldwin phone unit in good condition, type C or G, condition of case unimportant. Write E. L. Neill, Box 33, Cleburne, Texas.

WANTED—Hickok tube tester 510 or 532, counter or portable type, in good condition. Also Rider's manuals 2, 3, 4, 5. Cash. Leonard Peak, 1920 N. Spaulding, Chicago 47, Ill.

SELL OR SWAP — 10,000 V. 23MA transformer taken from oil burner. Good condition, suitable for experimental work. Geo. Wechsler, 1729 E. 17th St., Brooklyn 29, N. Y.

SELL OR SWAP—Portable single play phono, with 3-tube amplifier, volume, tone controls, 5" speaker, lightweight pick-up. $25 or equal in trade. H. Kanter, 1301 E. 57th St., Brooklyn, N. Y.

FOR SALE—Write for surplus list containing brand new Westinghouse meters and many other items. Alfred C. Denson, 38 Park Place, Rockville, Conn.

SELL OR SWAP—Dumont 5" 'scope 274; Supreme combination tester 599a; RCP sig generator 650; de Forest's 1946 radio course. All perfect condition. Need communications receiver, typewriter, automatic 22 rifle or target pistol. John F. Raposa, Jr., 167 Washington St., Fall River, Mass.

SELL OR SWAP—Philco auto radio for 1935-37 Ford; Pilot 0-100-0-100; Kurs-Kash 0-100 and 0-180. Used var. condensers; I.F. coils; R.F. coils. Many other items, list free. Smajd Radio, 720 Meadow Ave., Joliet, Ill.

SELL OR SWAP — Teleplex telegraph machine A-1. John Zudell, 1968 E. 84th St., Lorain, Ohio.

FOR SALE—Lead-acid surplus aircraft batteries, new, dry charged for long storage life. 12AH 24AH. $10.50; 12V 17AH, $8.50; 24V 11AH, $15. Special price for orders for more than two. R. N. Esnoult, 229 N. E. 70th St., Miami 38, Fla.

FOR SALE—T.T.I. television chassis with 7" tube in fair working condition with schematic, less than parts cost $75. Cash or C.O.D. J. I. Frieman, 5025 Arch St., Philadelphia 39, Pa.

FOR SALE—Brand new 1 KW motor-generator from army tank, 24 V., 75 Amp. D-C motor and 230 V., 4.6 Amp. D-C generator. Rewind two coils for heavy duty welding, $42. H. Balerlein, Box 415, Camden, N. J.

SWAP—RCP electronic multi-tester 669, used 30 days, in good condition. Want late model signal tracer. Chas. C. Butler, 616 E. 5th, Cherryvale, Kan.

SELL OR SWAP—Vomax VTVM in A-1 shape, used 3 months, calibration perfect. Need portable tester like Supreme 592. Ray F. Knoepfler, 1059 Rockman Pl., Rock Hill 19, Mo.

SELL OR SWAP—Small klein lights; speakers; tubes; gift items; unused U.S. postage; Want 8mm projector, record player, small vacuum cleaner. G. Zamkofsky, 537 Belford Pl., Brooklyn, N. Y.

WANTED—Used volt-ohmmeter; Precision or Supreme tube checker; H. Wager, 211 Tulip Ave., Franklin Sq., L. I., N. Y. State price and details.

SWAP—21 jewel Elgin pocket watch and 14 k. white gold chain for tube tester or vacuum tube volt-ohmmeter. Robert R. Hurd, 1713 W. 15th St., Topeka, Kans.

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The Sprague Trading Post is a free advertising service for the benefit of our radio friends. Providing only that it fits in with the spirit of this service, we'll gladly run your own ad in the first available issue of one of the six radio magazines in which this feature appears. Write CAREFULLY or print. Hold it to 40 words or less. Confine it to radio subjects. Make sure your meaning is clear. No commercial advertising or the offering of merchandise to the highest bidder is acceptable. Sprague, of course, assumes no responsibility in connection with merchandise bought or sold through these columns or for the resulting transactions.

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Radio saturation is not in sight

By HUGO GERNSBACK

EVERY few years, unimaginative radio people—who really should know better—begin to have grave doubts about the future of radio. This hoary, old depresser has been paraded before the radio world ever since the boom of 1922. It continues to pop up with irritating regularity.

To show how foolish and completely without merit these dark forebodings are, let us look at the record.

From the best available estimates there are now at least 35 million homes equipped with radios. This leaves out automobile radios, radio sets in factories, commercial institutions, and others. The total number of radio receiving sets in the United States in 1946 was computed to be somewhat above 60 million.

If we look at the curve of radio sets in use in the United States we will observe that ever since 1922, when radio broadcasting started, the curve has been one of practically uninterrupted ascent. This curve will not change appreciably in this country for a long time to come, for the following simple reasons:

There was the time when radio sets were used strictly for receiving purposes; news, entertainment, music, etc. Times have now changed. In the future there will be many new and different types of radio sets aside from the ones now in vogue. Take, for instance, the rise of radio amateur sets, which now run into the hundreds of thousands.

In the late 20's we started to install radio sets in cars purely for entertainment purposes, like the radio in the home. Already the radio telephone set, for communication purposes, has been added and is now expanding at an extraordinary rate. With some 26 million passenger automobiles in the United States today the time is not far distant when a very large percentage of automobiles will be equipped with these two-way telephone radios, plus a radio set for entertainment and news, etc., which means that soon there will be *two* radio sets in an automobile.

How many millions of the two different types of car radios there will be during the next ten years is a guess today. At least every business man who owns a car will want to have a communication radio set in his automobile. The limit is apparently only the ability of the telephone companies to manufacture these sets fast enough and install them.

Originally we started out with one radio receiver in the home. Now a very large percentage already has two and three sets; one in the living room, one in the bedroom and children's room, and in the servants' rooms —even an appreciable percentage is in the bathroom.

Where this tendency will stop no one knows, but the chances are that *three radio sets in the home* will certainly be the average before very long.

We next come to a type of radio which was not on the horizon even a few years ago. That is *Citizen's Radio*—the type with which a person can communicate directly with another, by means of ultra-short waves. How many of these radios will come into use during the next decade is difficult of computation, but there certainly will be millions of them.

Next on the list we have the *facsimile radio*. Already newspapers are broadcasting the printed word over facsimile sets in a number of cities in the United States so that with your breakfast in the morning you have spot news on a sheet of paper issuing from your radio set! This is a comparatively new type of radio set on the market, and although it has been known experimentally for several decades, no practical set has been turned out in quantity until recently.

Another type of specialized radio set which is about to make its appearance is the small receiver, the size of a cigarette pack. This will be kept either in your pocket or on your desk at home or in the office and will be designed for only one purpose—time and brief news announcements. You pick up the tiny set any time during the day or night and you will have the time, weather reports and other news shorts. Only a single station will be received with such sets. It is conceivable that anywhere between 30 to 50 million of such receivers will be sold during the next few decades, for the important reason that they are really a necessity in this country.

Still another type of radio—now already beginning to emerge—is the pocket type broadcast receiver. This small type of miniature set—forecast in these pages for several years—is now a reality. When we speak of pocket sets we really mean the type of radio receivers small enough to fit into the vest pocket—a set not much bigger than a pack of cigarettes. There is an enormous demand for such novelty sets. Whenever news appears that someone is bringing out such a receiver the manufacturer is immediately swamped with mail. It probably will be another five years before these radios have been perfected so that they will stand up under *all* conditions and that the reception will be entirely satisfactory to the public. That over 50 million such sets will be sold in this country within an appreciable time is a foregone conclusion.

Add to this the utility sets, such as are used in factories, offices, restaurants, and other commercial houses.

In factories where there is tedious work, radio has been found to enhance the morale of the workers. It speeds their work and improves general conditions. In many plants, where there is much noise, the ordinary type of public address system is often not feasible and in smaller factories individual sets are used right alongside the workers.

If we add up all these different types of radio sets it becomes apparent that *(Continued on page 91)*

RADIO-ELECTRONICS

Items Interesting to

CALLING - CARD RADIOS were demonstrated by Dr. Cledo Brunetti at the annual meeting of the Institute of Radio Engineers early in March. Not only did he operate a receiver printed on a card 3 inches long and 2 inches wide, but he operated it with a transmitter small enough to be kept in an old lipstick

A complete "calling-card" radio receiver.

case! Dr. Brunetti spoke into a lapel microphone as he walked about the stage, his words being picked up by the calling-card receiver and further amplified through a standard amplifier to fill the large ballroom in which the meeting was held.

The radios are all constructed by the "printed-circuit" technique first described in RADIO-CRAFT in April and June, 1946. The lipstick-size transmitter actually has the coils painted on the glass of the tube itself. A flat disc-shaped condenser, less than a quarter inch across, and a painted resistor complete the circuit. Battery and microphone complete the equipment.

"Lipstick" transmitter used by Dr. Brunetti.

The little radios, of which Dr. Brunetti had nearly a dozen on hand, were built by a group of Bureau of Standards scientists working under his direction.

TWO FM RADIO STATIONS in New York City were asked last month by the FCC to adopt new frequencies to avoid interference with aircraft instrument landing systems. The interference is due to technical shortcomings in the aircraft receivers—designed before FM moved to its present frequencies—and the use of new frequencies is to continue only until March 1, 1948, by which time it is expected that all aircraft can be equipped with apparatus of modern design.

Since the users of ILS equipment concede that FM broadcasters are technically blameless for the flying hazard created by their transmissions and that the aviation industry simply has been caught in the unfortunate position of equipping itself with war-time receivers which did not have to contend with the problem of FM interference, they are endeavoring to work out a method whereby they can defray the cost of the FM operators' temporary frequency shift.

RADIO TECHNICIANS of San Francisco last month embarked on a plan of study designed to prepare them for the new world of frequency modulation. Seventy members of Radio Division No. 1245 of the Brotherhood of Electrical Workers registered for night school courses at Radio KALW in the Samuel Gompers Trade School, San Francisco.

The courses are being handled under a three-cornered co-operative arrangement between the Board of Education, the union and the manufacturers of FM equipment. Courses are being taught under the direction of Kenneth Nielsen, chief engineer of KALW. Various manufacturers have pledged their assistance in making the studies effective, and the General Electric Co. has supplied each student their FM instruction booklet, as well as service notes applying to current G-E FM receivers.

COMMERCIAL MICROWAVE relay circuits are being installed for the first time, officials of Raytheon Manufacturing Co. announced last month.

The microwave links, which will represent the first commercial use of such relay circuits, will operate between the Canadian Marconi Montreal office and two other points, Yamacaiche, about 35 miles away, and Drummondville, 100 miles distant.

Installation of the new circuit follows experimental work by Raytheon on its New York-Boston microwave circuit. The company is carrying on extensive propagation studies, looking toward the elimination of noise through use of high-power magnetron units.

FCC'S LATEST MEMBER is Commodore Edward Mount Webster, who was formerly in charge of Safety and Special Services for the Commission.

Commodore Webster has been in the communications field from the time of his graduation from Coast Guard Academy in 1909 to the present. He served as assistant chief engineer of the FCC from 1938. Like his former chief, Ewell K. Jett, now also a Commissioner, he is an independent in politics, and has never voted.

VLADIMIR K. ZWORYKIN, leading American television engineer, received two signal honors during the past two months. The first, award of the Potts medal of the Franklin Institute, occurred March 3. On March 7, RCA's president David Sarnoff announced that Zworykin had been elected Vice President and technical consultant of the RCA Laboratories, where he has done much of his important work.

Besides his achievements in the field of television and the electron microscope, Dr. Zworykin has been interested in other branches of the electronic art, and during the war directed research in the development of aircraft fire control, infra-red tubes for the sniperscope and snooperscope, television guided missiles and improvement of radar systems. He is now directing work on an electronic calculator which he believes may make possible accurate meteorological predictions and ultimate control of weather.

IGNITION INTERFERENCE in television and high-frequency radio receivers can be eliminated, a joint committee of the Radio Manufacturers Association and the Society of Automotive Engineers reported last month. The committee made four recommendations:

1. Locate the high-tension coil to permit an 8-inch or shorter lead from coil to distributor.
2. Keep primary electrical wiring metal rods and conductive tubing as far from high-tension wiring as possible.
3. Use a 10,000-ohm suppressor in the distributor-to-coil high-tension lead.
4. Use a 10,000-ohm suppressor at each spark plug.

The Automobile Manufacturers Association has adopted the recommendations in principle, and has asked all bus, truck and car manufacturers to begin immediately to prepare their vehicles to meet the recommended tolerable interference limits by Jan. 1, 1948, but asked that installation of resistors be deferred until tests now under way have been completed.

MONTHLY REVIEW

the Radio Technician

TAXATION ON TELEVISION in public places will not be levied, the Bureau of Internal Revenue announced last month, putting an end to earlier rumors.

Under the law, the tax applies to all establishments which provide entertainment "other than instrumental or mechanical music." An answer of the Bureau to an inquiry by a New Jersey collection official made it appear that television was therefore considered taxable, but the Bureau later formally stated that television is not "live" entertainment and therefore not subject to tax.

MAGNETIC WIRE RECORDERS plus radio-phonograph combinations were placed on the market for the first time last month by a Chicago department store and mail-order house. Price of the combination, described as a low-cost item, is in the order of $170, and comprises a straight record player (without record changer) a superheterodyne radio and the magnetic recorder.

MICROWAVE DIATHERMY equipment was released for the first time to the medical profession last month, a Raytheon report states. The apparatus operates at 2,450 mc, almost 100 times higher than the present 27-mc diathermy band.

Diathermy investigators, including Dr. de Forest, have suggested that extremely high-frequency treatments might be especially valuable, but have been hampered by lack of suitable equipment.

The new *Microtherm* u.h.f. waves are directed at the patient like a beam of light, eliminating electrodes or "pads" which have to be strapped on. Due to its faster absorption than lower frequencies, less power is required, and a small portable unit can be used.

The FCC has made available the frequency band of 2400 to 2500 megacycles for industrial and medical applications. Use of the magnetron oscillator at these frequencies will not give rise to the objectionable radio interference which has been so common with the older type of diathermy.

ELECTRICAL UNIT CHANGES will be introduced January 1, 1948, the Bureau of Standards announces. The electrical units of the "international" system will be superseded by those of the "absolute" system derived from the fundamental mechanical units of length, mass and time.

The changes will not be great enough to be noticeable in most practical measurements, but will affect those of high precision. The new values as compared with those now recognized by the United States are:

1 international ohm	=	1.000495 absolute ohms
1 international volt	=	1.00033 absolute volts
1 international ampere	=	0.999835 absolute ampere
1 international coulomb	=	0.999835 absolute coulomb
1 international henry	=	1.000495 absolute henries
1 international farad	=	0.999505 absolute farad
1 international watt	=	1.000165 absolute watts
1 international joule	=	1.000165 absolute joules

New units for the measurement of light will be introduced at the same time, according to the Bureau of Standards.

FIRST ALL-RADAR airway will be installed in Alaska, the Army Air Forces announced last month.

The AAF will use "racon" type radar navigational beacons at Shemya, Adak, Anchorage, Ladd Field (Fairbanks) Nome, Fort Randall and Point Barrow, providing radar coverage over the entire Alaskan airways system.

AUSTIN C. LESCARBOURA, one of the earliest editorial associates of the Gernsback publications, last month received from the Republic of France the order of *Officier de l'Instruction Publique*. The honor is in recognition of technical and literary services rendered for many years past.

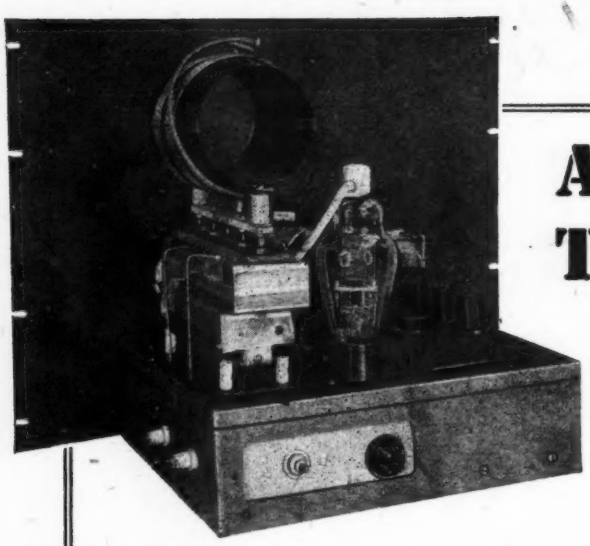
Mr. Lescarboura was one of the first

managing editors of the original Gernsback magazine, MODERN ELECTRICS, and was later managing editor of *Scientific American* and editor of *Popular Science Monthly*. He has written and edited a number of books on radio subjects, and is a frequent contributor to technical publications both in the English and French languages. As correspondent for the Physics Department of the University of Lyons, he has kept that faculty in touch with the progress of radio-electronic science in America. More recently he has acted as consultant for visiting members of the French Mission for Industrial Production. He holds a second French decoration, *Officier d'Académie*, awarded for services to France and the Allies during World War I.

COLOR TELEVISION is not yet ready for commercial exploitation, the Federal Communications Commission decided last month. The FCC decision came after several hearings in which Columbia Broadcasting System led the proponents of immediate color television and RCA spoke for those who believe color is not yet ready for the public. Both sides backed their arguments with showings of color television.

"The commission cannot escape the conclusion," the FCC said in a fourteen-page decision, "that many of the fundamentals of a color-television system have not been adequately field-tested, and that need exists for further experimentation."

Television broadcasters and manufacturers interpreted the ruling as giving a green light to black-and-white television and some predicted that greatly expanded production would result almost immediately.



AN ECONOMY TRANSMITTER

This 225-watt transmitter can be built for only $16

By R. F. SCOTT, W2PWG

A STAND-BY transmitter was needed to keep W2PWG on the air while rebuilding the regular rig. A little thought, plus careful selection of parts and use of those already on hand, produced this 225-watt c.w. transmitter at a cost of a little more than 7 cents a watt.

The panel and the coil turret were purchased at amateur net cost. Four crystals, an 811, three 500-watt tank coils, and the tank tuning condenser—purchased at bargain prices from government surplus stocks—brought the total cost to slightly over $16.00. All other parts were resurrected from the junk box.

Three stages are used in the transmitter. A 6C5 Pierce oscillator simplifies operation by eliminating both tuning in the oscillator circuit and neutralization of the buffer-multiplier stage. Any one of four crystals may be switched into the oscillator circuit from the front panel. A 50-μμf mica condenser across the grid leak provides sufficient regeneration to give trouble-free oscillator operation even with the most sluggish crystals.

The buffer stage

The 6L6 buffer-multiplier is capacity-coupled to the oscillator. Parasitic suppressors, Rsp, in the grid and screen grid leads consist of 6 to 8 turns of No. 16 enamel wire wound around a 50-ohm, 1-watt resistor. The plate of the 6L6 is series fed through a Barker & Williamson Type 2A band-switching turret. This stage is tuned by a 140-μμf receiving type variable condenser controlled by a knob on the front panel. The knob on this control should be a good electrical insulator with its setscrew well removed from possibility of physical contact with the operator. The turret permits the 6L6 to work as a buffer when working "straight-through" and as a multiplier on 40, 20, 15, or 10 meters. With this arrangement and a suitable crystal, W2PWG hopes to be one of the first signals on the proposed 15-meter ham band when it is officially opened.

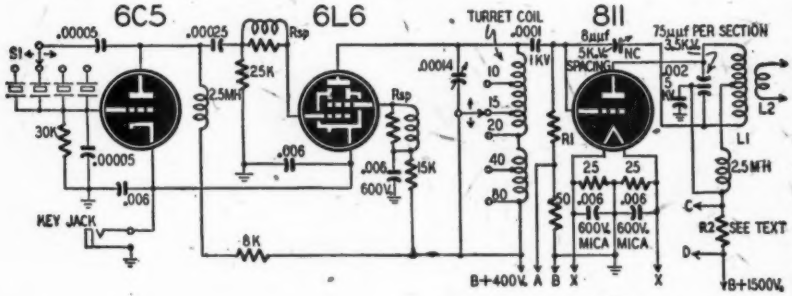
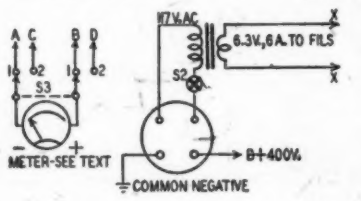


Fig. 1—Schematic of the economy transmitter. Bandswitching is used on the buffer and plug-in coils on the output tank. The 4-prong socket is a male receptacle for the a.c. line supply to the filament transformer, also the low-voltage leads from the pack. The 1,500-volt lead is brought in separately.



Final amplifier stage

The 811 was chosen as a final amplifier because it has a reasonably high plate dissipation factor (55 watts), can be driven by the 6L6—even when quadrupling—and its high-mu characteristics permit operation without fixed bias although preceding stages are keyed. Other triodes, such as the HK54, T55, T40, TZ40, and 812, can be used with minor changes in voltages and circuit constants. The 811 draws 35 ma grid current through its 3,200-ohm grid leak to produce 112 volts of operating bias with 1,500 volts on the plate. If the plate voltage is reduced to 1,250 or 1,000 volts, the grid leak R1 should be replaced with a 2,500-ohm, 10-watt unit.

A series-fed, plate-neutralized tank circuit is used. The rotor and stator of the tuning condenser are connected to the high-voltage lead and the r.f. is bypassed to ground through a 0.002-μf, 5,000-volt condenser. The tuning condenser was originally a 160-μμf, single section unit with 3,500-volt spacing between its plates. The present connection reduces the required condenser spacing by about 50 percent. It was salvaged from a Type A-27 phantom antenna unit formerly used with Army radio sets SCR-193 and SCR-506, and converted to split-stator connection by removing the center stator plate and cutting a ⅝-inch gap in the center of each stator connecting bar. It is mounted on ½-inch standoff insulators to insulate it from the chassis.

The tank coils used in this rig are available at most radio surplus stores. They are fitted with special terminal blocks which will not fit standard jack bars. Substitute bars may be made by drilling properly spaced holes in ¼-inch bakelite or mycalex strips and mounting shallow banana jacks in the holes. The assembly is then mounted on the frame of the condenser with L-shaped brackets.

The neutralizing condenser NC has its rotor connected to the grid of the 811

and its stator to the bottom end of the tank coil to prevent the operator from coming in contact with high voltage. An insulated knob is used to avoid r.f. burns.

Special construction features

The 9 x 12 x 3-inch chassis permits all parts to be mounted without crowding. Four sockets are mounted in the left front corner. Two of these are for oscillator and buffer, the other two for crystals. Each octal socket will hold two crystals if they are mounted in the new type holders—most surplus stock crystals are. Five symmetrically spaced holes are drilled in the front skirt of the chassis for mounting the key jack and the crystal, and the band-changing, meter and filament switches.

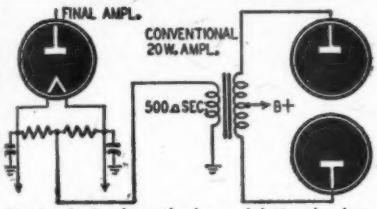


Fig. 2—A simple cathode modulation hookup.

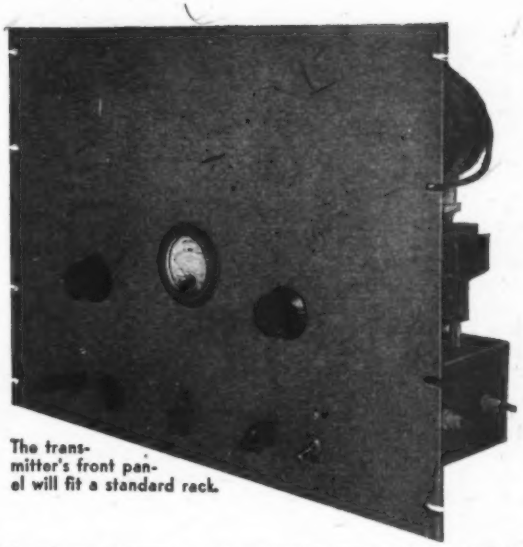
A 4-prong socket in the rear skirt is the input terminal for a.c. leads to the filament transformer and the common ground and low-voltage connections. The positive high-voltage line enters the chassis through a ceramic feed-through insulator.

The internal shunt was removed from an old 3-ampere meter, which was then found to have an 8-ma movement. A shunt was wound to give a 90-ma full-scale deflection. When the meter switch, S-3, is in position 1, it is connected across a 50-ohm, 1-watt resistor in the 811 grid return, making it possible to read the grid current without opening the circuit. To read plate current, the meter is switched across R2, a shunt wound to give 300-ma deflection. With the meter used, the shunt consisted of about 2 feet of No. 22 enameled wire. Almost any available meter may be used if shunts are wound to provide the required range or ranges.

Tuning and tuning coils

The transmitter is connected to a 400-volt, 100-ma. power supply for the oscillator and buffer stages and to 1,500 volts for the final amplifier. The filaments are allowed to preheat for a few seconds and plate voltage is applied to the oscillator. A key in the cathode circuits of the low-power stages is closed and the final amplifier neutralized by conventional methods with the grid current meter indicating neutralization.

After neutralization, high voltage is applied to the final amplifier and the antenna coupling is adjusted to draw 150 ma of plate current. Under these conditions, the grid current is between 30 and 35 ma and the power output approximately 170 watts. When operating straight through, it may be necessary to detune the buffer to avoid overdriving the final grid. With active crystals and a high-C buffer tank circuit, it is often possible to excite fully the final grid on 10 meters with the oscillator operating on 80. For 15-meter operation, the 6L6 may be used as a tripler with 40-meter crystals in the oscillator.


The transmitter's front panel will fit a standard rack.

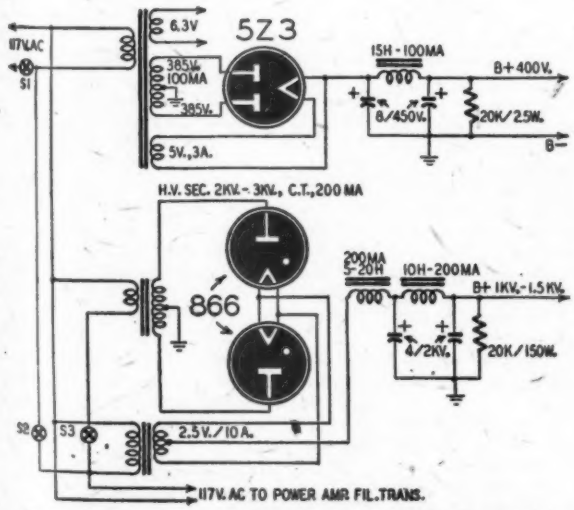
If manufactured coils are undesired or unavailable, coils may be wound from data given in the table below. In this event separate plug-in coils are wound for the buffer stage.

BUFFER COIL TABLE

BAND	TURNS	WIRE SIZE	WINDING SPACE
80	30	No. 22 en.	1½ inch
40	15	No. 22 en.	1¼ inch
20	8	No. 16 en.	1¼ inch
15	5½	No. 14 en.	1½ inch
10	3	No. 12 en.	Spaced to hit band with low C.

The 10-meter coil is air-wound and self-supporting. The others are wound

(Continued on page 73)



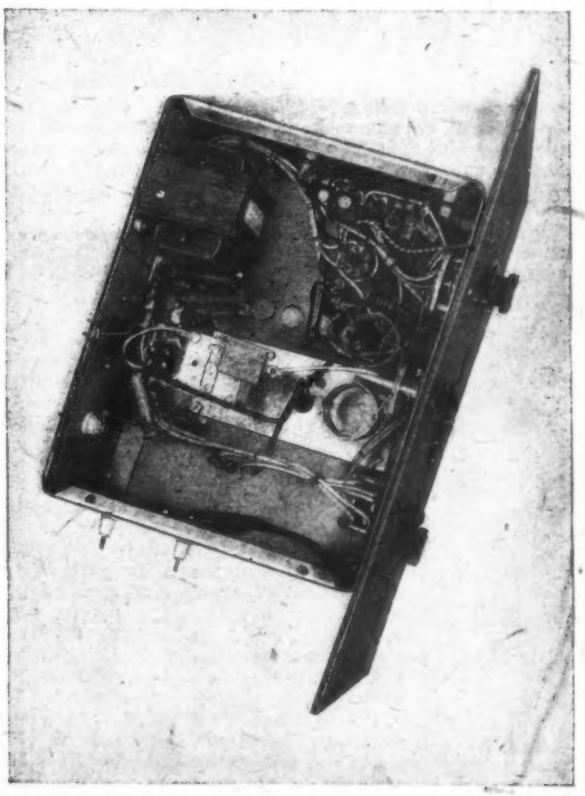


Fig. 3, above—The power supply used for the standby transmitter. Right—Underchassis view shows filament transformer, buffer coils.

Efficient Test And Repair Bench

By C. A. BROWN*

THE radio service bench has always been the object of many discussions, arguments and opinions. Scores of articles have been published on what should constitute a radio service bench. We built up several experimental benches and installed them in a radio service shop. The reactions of radio technicians and customers alike were carefully noted, and those ideas which did not meet with their approval, were weeded out. We came to the following conclusions:

1. A radio service bench must be more than just a bench. It must be a place to test any electronic device efficiently. The test equipment must be permanently mounted to do away with dangling wires, cumbersome connections, and other haphazard devices. Instruments must be placed so they can be easily read, either standing or sitting. Lighting must be glare-free.

A slightly tilted panel, with a satin white finish, made of a nonconducting material, which is strong but easily cut and drilled, was found most suitable. At the top of this panel a fluorescent light is mounted.

*Servelux Mfg. Co., Grand Rapids, Michigan

2. One must have a place to perform any operation the radio or other electronic device needs. The space must be large enough to accommodate several radios at once, or a large multiple-unit job, and still have ample room to maneuver. The surface must be smooth, easily kept clean, and nonconducting. Battleship linoleum was chosen as the ultimate in top surfaces.

3. The problem of where to keep tools. Certainly not just anywhere, especially not on the working surface where they are always under the thing you are working on. That goes also for those bottles of speaker cement, solvent, contact cleaner, etc. A tool and chemical rack has been incorporated in the instrument panel, in a smooth basic design, not tacked on. It is an integral part of the equipment. The parts storage problem has been licked too. Two large, deep cabinets of drawers form the supports for the working surface and the instrument panel. These drawers are of varying depths and are compartmented. There is a drawer for special tools, those not used in every job, but very important when needed. Besides being compartmented these drawers are labeled as to specific values and form a perpetual inventory of parts. Two tray drawers in the front edge of the working surface receive parts removed from radios, such as bolts, nuts, knobs, dial glasses and pointers.

4. Here are two problems very often overlooked: The radio service unit must be at least semi-portable and should be constructed so instruments can be easily connected to the power line and easily serviced.

The instrument panel can be cut and drilled for any instrument, and power outlets for instruments are provided in

(Continued on page 74)

King of Tube Checkers

COVER FEATURE

THE increasing use of kenotrons has increased in turn the need for equipment with which they may be tested. The kenotron is a high-vacuum rectifier, especially built for high voltages. Ratings are from 40,000 to 150,000 volts, with outputs from 100 ma to ¾ ampere. One of the most important uses of kenotrons is for the concentration of uranium for development of atomic energy. They are used in the electromagnetic plant at Oak Ridge, Tennessee, one of the largest units of the atomic project.

G-E kenotron GL-411, a 150,000-volt tube.

Power supplies for this uranium-concentration equipment were especially designed, and special tubes had to be developed for them.

Naturally a checker to test and measure the characteristics of these tubes became a necessity. The instrument on our cover is that tester.

This equipment, developed by the General Electric Co. to check their high-voltage kenotrons, subjects the tube under test to a continuous series of impulses of various duration and magnitude. The operating cycle of the equipment is completed in 60 seconds, and consists of 6 5-second intervals, 3 seconds of 60-cycle impulses, followed by 2 seconds of continuous voltage application; a 17-second rest period, followed by 2 seconds of 800- to 1500-cycle impulses, with the remaining 6 seconds as a rest period. This cycle is repeated automatically for the specified test time and for the conditions of voltage and current required.

During this test a tube which is normally rated at 20,000 watts plate dissipation receives impulses of a maximum of 50 kilovolts and 75,000 watts. The tube must withstand these impulses without change in the tube current and without excessive arc-backs.

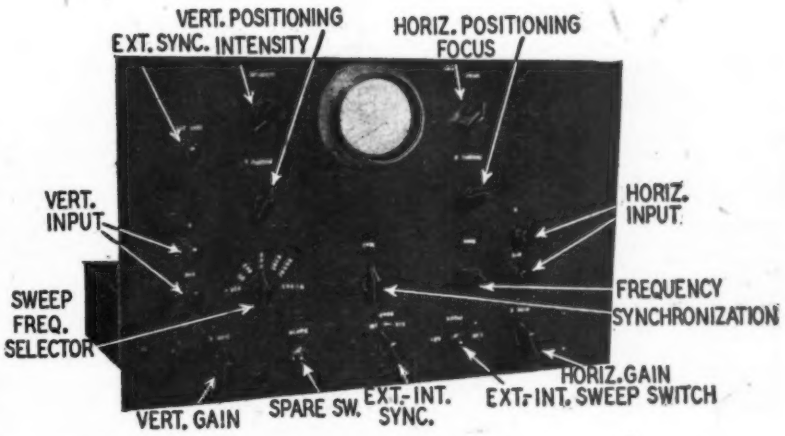
The test cycle is automatically controlled by the timing switch mounted on the inside test panel. The operating controls and meters are all mounted on this control panel which is located so that the operator can observe the tube during the test period.

The high voltage required for the test is obtained from two 6-tube rectifier units mounted in the back of the test cage. These rectifiers may be placed in series or in parallel, depending upon the conditions required for test. These

(Continued on page 74)

Easy-To-Build Oscilloscope

By B. W. SOUTHWELL



All controls and input and output connections are clearly marked in the photograph above.

THE 3-inch oscilloscope diagrammed in Fig. 1 uses a single-stage 6J7 in the horizontal and the vertical amplifier. This single tube provides ample amplification for a cathode-ray tube of the size used. The gain of the horizontal and vertical amplifiers is in the order of 30.

The cathode-ray tube, together with its amplifiers and gas-triode horizontal sweep generator, is built on a 12 x 17 x 3 inch chassis. The front panel is 12 x 19½ x ⅛-inch steel. The power supply was originally built on the right side of the scope chassis, but it was later rebuilt on a separate 7 x 15 x 3-inch chassis because the transformers' magnetic field was strong enough to influence the electron beam between the deflection plates and the fluorescent screen. This magnetic interference was very bothersome and interfered with interpretation of patterns on the screen. Magnetic fields cause depositioning, relative tilting of the deflection axes, and other spurious deflections, and can magnetize the cathode-ray tube electrodes.

Looking at the front-panel view, the controls are: top left, intensity control; directly below it, vertical positioning; top right, focus control; below it, horizontal positioning. Below the vertical position control and going from left to right are the sweep-frequency selector switch, synchronization and frequency controls. The bottom row contains the vertical (Y-axis) gain, toggle switch (not connected, for future use), sync selector switch (3-pole, single-throw for internal, 60-cycle, and external), single-pole, double-throw toggle switch for horizontal sweep (internal or external), and horizontal (X-axis) gain. To the left of the intensity control is external sync binding post. Below it are the vertical input binding posts. Horizontal input binding posts are on the right-hand side of panel.

The 3AP1 cathode-ray tube is located in a horizontal position midway between the intensity and focusing controls. The tube is enclosed in a stovepipe shield of 3-inch diameter which extends to its base. The pipe shield is supported at the panel end by insertion into a snug-fit hole in the panel and by a piece of 5/16-inch brass rod, drilled and tapped and fastened to the pipe and chassis at the tube base end. The cathode-ray tube measures 3-1/16 inches in diameter across the face and hence will not fit into the shield at the front. The shield should be lined with a strip of sponge rubber ½ inch wide and 3/16 inch thick at the front-panel end to form a shock-absorbing mount for the 3AP1. A flange 3⅛ inches in diameter and 1 inch deep projects in front of the panel over the protruding tube, and serves both as a protection and as a light shield. For details of construction of shield see Fig. 2.

Fig. 3 is the dimensional diagram of the support for the 3AP1 tube socket. The bakelite panel for making direct connections to vertical or horizontal deflection plates is a great convenience when working with d.c. or high-frequency applications. The tube socket support itself is constructed of 16-gauge galvanized sheet metal.

Amplifiers and sweep circuits

All wiring in deflection amplifiers together with the filament supply of the 3AP1 are run through shielded wire to minimize a.c. pickup. An extra tube socket was installed for the incorporation of an external Z-axis (blanking) amplifier at a later date. A portion of the signal on the plate of the 884 gas triode is fed through a 50-μμf condenser (1,000 volts working) to the intensity grid to blank out the return trace of the beam during its tracing of a pattern. This is internal blanking. This signal is opposite in polarity to that at the plate of the horizontal amplifier. Peaking coils containing 55 turns of No. 34 enameled wire, wound on a ½-inch bakelite form, are inserted in the plate circuits of the horizontal and vertical amplifiers to prevent loss of the high frequencies. Peaking inductances are used to compensate for the decrease

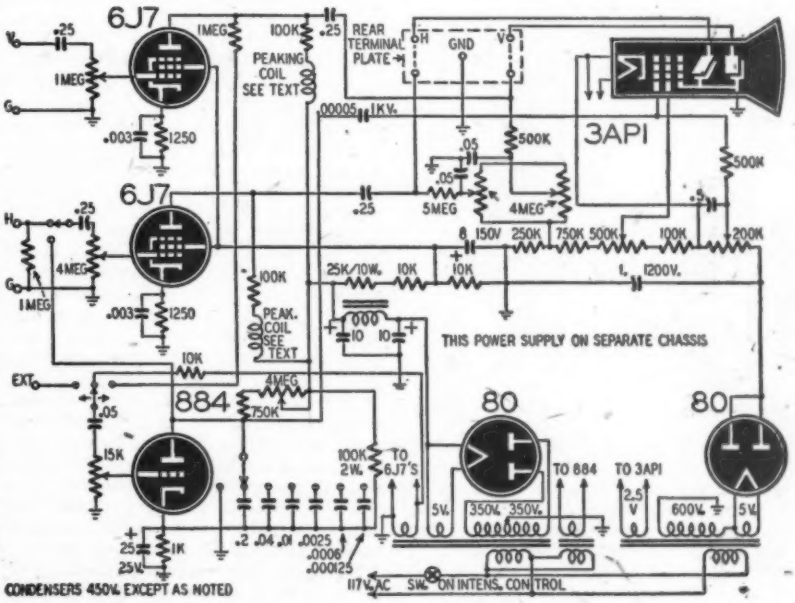


Fig. 1—This efficient oscilloscope circuit is simply designed and uses a minimum of tubes.

in plate-load impedance with frequency. Too large an inductance for a given resistance will cause nonuniform gain as a result of peaking in the network response at some frequencies. Too small an inductance will not give maximum band width for uniform response.

The vertical or Y-axis amplifier should reproduce faithfully square waves from 10 to at least 100,000 cycles/sec. For perfect square-wave reproduction an infinitely wide band of frequencies must be passed without attenuation or relative phase shift. A square wave is analyzed in terms of its harmonic content, taking the repetition rate as fundamental. The horizontal or X-axis amplifier should be capable of reproducing a linear sweep of saw-tooth voltage up to 100,000 cycles/sec. A wave form resulting from a nonlinear sweep

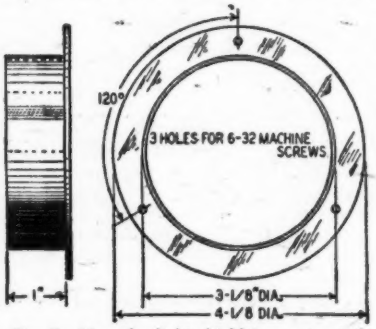


Fig. 2—How the light shield is constructed.

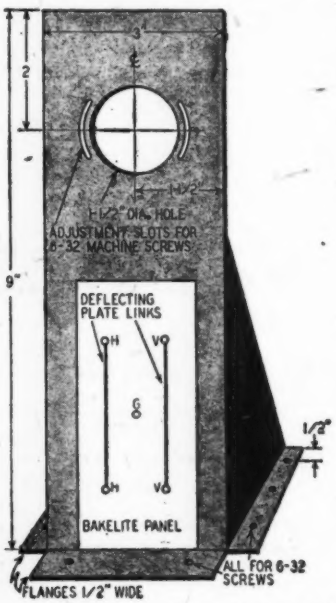


Fig. 3—Rear support of the cathode-ray tube.

is shown in Fig. 4. Pattern is bunched together at one end. A saw-tooth sweep gives a deflection linearly proportional to time. A sinusoidal sweep is used for phase and frequency determination. The horizontal and vertical amplifiers should have phase characteristics of identical nature.

The horizontal amplifier may be switched to amplify either the linear time-base signal from the 884 sweep oscillator or any externally provided signal.

The linear time-base horizontal sweep has 7 changes of frequency in rough steps. These are approximately:

Position 1—Sweep off
Position 2—20 to 70 cycles
Position 3—60 to 250 cycles
Position 4—220 to 950 cycles
Position 5—900 to 3,200 cycles
Position 6—3,000 to 11,500 cycles
Position 7—10,000 to 33,000 cycles.

In series with the switch arm controlling these steps is a 4-megohm potentiometer which permits a fine frequency adjustment over each frequency position range of the 7-position rotary switch. The sweep circuit proper utilizes a grid-controlled 884 gas-triode tube in a synchronized relaxation oscillator. The sweep condensers are connected from plate to cathode of the 884 separately by a rotary selector switch for the determination of sweep frequency desired. The condenser is allowed to charge up to a potential determined by the breakdown potential of the tube. This voltage output, which consists of saw-tooth waves (see Fig. 5) from the

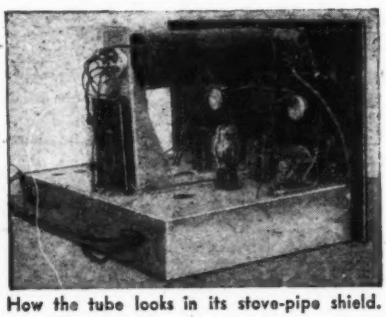

How the tube looks in its stove-pipe shield.

plate of the 884, is coupled to the grid of the horizontal amplifier to be amplified before reaching the horizontal plates of the 3AP1.

Synchronization and positioning

A portion of the output of the 6J7 vertical amplifier tube is coupled to the grid of the sweep tube to provide synchronization to maintain a stationary pattern on the screen of the cathode-ray tube. Synchronization provides for 180-degree phase shift. Oversynchronization (sync-control potentiometer advanced too far) results in a poor wave form. Figs. 6 and 7 show properly synchronized and over synchronized patterns.

A single-pole, 3-throw switch on the panel provides for internal synchronization in position 1. Position 2 switches in 60-cycle or line frequency through a 10,000-ohm, ½-watt resistor connected to the ungrounded side of the filament leads. A separate filament transformer is required for the 884 tube as the filament is not grounded on one side. Position 3 connects the grid of the 884 discharge tube to the external sync binding post on the front panel.

Horizontal and vertical positioning of the pattern is obtained through a voltage divider circuit using two 4-megohm potentiometers. These potentiometers apply a positive or negative voltage to the free deflection plate of each pair. As the electron beam in a cathode-ray tube consists of negative charges of electricity, it can be readily seen that, by applying a positive or negative voltage to either deflecting plate, the spot position on the screen can be controlled. The intensity control controls the brilliancy of the pattern by applying to the control grid of the 3AP1 a greater or lesser negative voltage.

The power supplies are conventional. One 80 operates as a full-wave rectifier supplying 250 volts. The other 80 operates with plates tied together as a half-wave rectifier. The output voltage of this half-wave supply is 850-900 volts.

Scope applications and patterns are too numerous to cover completely in this article, so a brief resumé of some of the more commonly encountered wave forms

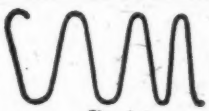


Fig. 4
Wave form caused by non-linear sweep.

Fig. 5
The correct saw-tooth sweep wave form.

Figs. 6 and 7
Good and bad synchronization.

Fig. 8
Vertical to horizontal frequency 1:2.

Fig. 9
Vertical to horizontal frequency 1:4.

will be given. It is general practice when observing wave forms to use several waves on frequencies of 1,000 cycles and above.

Some oscilloscope applications

Fig. 8 shows the pattern obtained when vertical frequency is half the horizontal sweep frequency. For example, a signal of 60 cycles is applied to the vertical plates and a saw-tooth wave of 120 cycles to the horizontal plates. Fig. 9 shows a pattern with vertical frequency one quarter that of the sweep frequency. When the vertical signal frequency is 3 times the sweep frequency, 3 complete wave forms will appear.

By switching the horizontal amplifier

(Continued on page 90)

MULTIVIBRATORS

By O. B. MITCHELL

THE multivibrator offers more possibilities for practical application in the field of electronics than possibly any other circuit, so it is desirable that we make its acquaintance. This simple circuit played an important role in the design of radar and other wartime electronic devices.

Let us consider the basic multivibrator schematic of Fig. 1. The circuit consists of a 2-stage amplifier with the output of V2 fed back into the grid of V1. Due to the phase reversal of 180 degrees in each stage, the feedback voltage is in phase with the original impulse on V1 grid. Thus, the circuit satisfies the conditions necessary for oscillation—amplification with positive feedback.

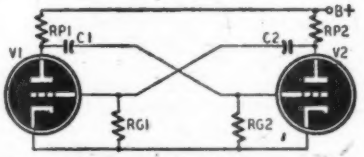


Fig. 1—The standard multivibrator circuit.

If we examine the multivibrator plate-current wave form of Fig. 2, we will better appreciate its possibilities. The current makes rapid excursions from one stable condition to a second stable condition. These rapid excursions produce a highly distorted output wave, which makes possible the many applications of the circuit.

Fig. 2—Form of multivibrator plate current.

To many radiomen, the multivibrator is primarily a useful means of generating harmonics for frequency measurements. It is the most practical means of generating 10-kilocycle calibration points. This technique has been adequately covered in technical radio publications and will be touched on but briefly in this article.

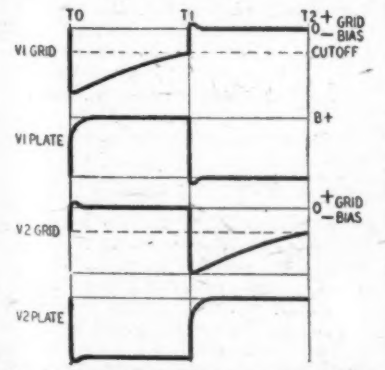


Fig. 3—Analysis of voltage over one cycle.

In Fig. 3 the circuit operation is graphically illustrated by a time-plot analysis. If what is taking place on the grid and plate of V1 or V2 were observed with a cathode-ray oscilloscope, the oscillogram would be similar to the wave of Fig. 3. The vertical lines T0, T1, and T2 are time designations, and intersect points on each of the waveforms occurring simultaneously.

Analyzing the multivibrator

Assume that at a given instant T0 the grid of V1 goes slightly negative, causing a positive increase in the plate *voltage* of V1. The positive increase is applied to V2's grid through C1, causing its plate voltage to drop. V1 grid is now driven far below cut-off by the negative pulse fed back from V2's plate through C2. All of the preceding action takes place instantaneously at T0.

The grid of V1 is held below cut-off by the negative charge of C2, which must leak off through RG1. During the interval from T0 to T1, the discharge of C2 takes place, and the circuit remains stable. The actual length in seconds of this time is approximately the product of RG1 x C2. This portion of the cycle ending at T1 is known as the *slow-phase* action.

Another action occurring during the first half-cycle of operation is known as the *rapid phase*. At T0, when the grid of V1 is driven below cut-off, the plate voltage of V1 would ordinarily be expected to rise immediately to the B-plus value. As seen from Fig. 3, this is not the case, since the plate voltage tapers off exponentially as it rises. This phenomenon is caused by the charging of C1 through the grid circuit of V2. The charging path of C1 consists of RG2 in parallel with the internal grid-cathode impedance of V2. At the time V2 grid is in the positive region, this impedance is low in comparison to RG2. Therefore, C1 charges rapidly as the grid is driven positive. This charging phenomenon of C1, during the first half-cycle, is called the *rapid-phase* part of the operation.

When the voltage on the grid of V1 rises above the point of cutoff (T1), the first half-cycle of the multivibrator operation is completed. V1 now begins to conduct, and the plate voltage drops, driving the grid of V2 below cut-off. The remainder of the second half-cycle is identical to the first half, with V1 and V2 exchanging places, so to speak. From T1 to T2 the grid of V2 is below cut-off and is held there by the charge on C1. RG2 now provides the discharge path for the second slow phase. Note that since V2 is now cut off, the internal grid-cathode impedance is extremely high and doesn't affect the discharge time of C1. V1 grid goes through the rapid phase on this half-cycle since this grid is positive at T1.

The grid of V2 reaches its cut-off point at time T2, as determined by RG2 x C1. At this time, the original half-cycle will repeat itself, and oscillation will continue as long as power is applied to the circuit.

One complete cycle of oscillation takes place during the time from T0 to T1. The total length of this time, or the period of one cycle of operation, is equal to the sum of the two slow phases of operation. These in turn are determined by the RC constant of the grid circuits of V1 and V2. The frequency of the self-oscillatory multivibrator is determined by the equation f equals $1/t$, where f equals frequency in cycles per second and t equals time or period of one cycle. In our case t approximately equals (RG1 x C2) plus (RG2 x C1). Actually, other factors are involved, but the above method is satisfactory for approximation.

Fig. 4—Synchronized multivibrator circuit.

Controlled multivibrators

If the circuit of Fig. 1 is triggered by an external impulse approximately equal, or harmonically related, to the natural frequency of the multivibrator, the circuit will oscillate in synchronism with the applied frequency. When this circuit is triggered, the frequency output of the multivibrator may be very accurately controlled by the exciting frequency. Either harmonics or subharmonics of an exciting frequency may be generated in this manner.

It is common practice to employ a 100-kilocycle crystal oscillator as the exciting frequency for a 10-kilocycle multivibrator harmonic generator. Such a combination, as shown in Fig. 4, provides accurate calibration points every 100 kilocycles throughout practically the entire useful radio spectrum.

In many electronic applications, it may be desirable to employ a multivibrator that will not oscillate unless it

(*Continued on page* 58)

Home-built Sound Effects

Simple equipment makes realistic sounds

"I WAS alone' whispers a husky voice from the radio. 'It was late at night. Through the fog came the faint swish of small waves, and a distant vessel hooted mysteriously. I slipped cautiously into an alleyway.' The voice ceases. Lapping water and a foghorn blend with the tinkling of a channel buoy. Footsteps ring sharply against the stones . . ."

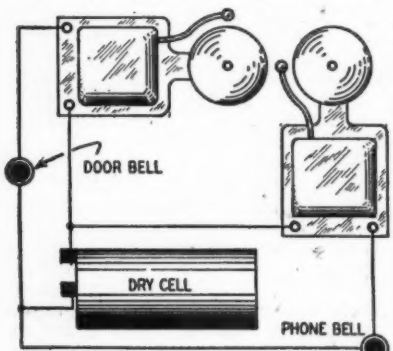


Fig. 1—Bell board produces several effects.

So commences a recent book* which tells how to make the sound effects for home recordings, excerpts from which are printed in this article. In the studio, the authors explain, an ingenious sound effects technician has flipped his fingers in a pan of water, blown a wooden whistle, struck a metal plate with a tack hammer, and marched along in a single spot, getting nowhere. Amplification and suggestion have converted the sounds to a waterfront scene.

Sound effects are to radio what seasoning is to food—without them it would sink into meaningless monotone, and many types of presentations would become impossible. Many of these effects are achieved very simply, and with apparatus which can be constructed by the home recorder or the small experimental studio operator.

Bells are among the commonest sound effects. A bell board is shown in Fig. 1. These two bells will serve you well as telephone bells, doorbells, riveting machines, buzzers, and rattlesnakes. Mount the bells on the board so the clapper of one will strike both gongs when that bell is rung. It becomes a telephone. The other can be used for doorbells.

All sorts of other bells, such as clock bells, dinner gongs, and school bells can be made with bowls and cake tins to be found around the house. A useful pair of bells appears in Fig. 2. One of these is a ¼ x 6 x 10-inch metal plate. The other is a piece of small pipe bent into a U-shape. Both are hung from a bar with leather thongs (never with wire).

The U-shaped bell is particularly useful where a quick clang is needed. The plate can be used for a variety of effects, depending on how it is struck and with what. Strikers can be bought from a music store, and are referred to as xylophone mallets, chime hammers, soft-hard mallets, and felt mallets. All are useful, and can be supplemented by a tack hammer and an ordinary pencil with an eraser.

Carry the eraser-tipped pencil around the house and strike flower vases, brass bowls, ash trays, and other objects. Every house is full of bells and chimes and gongs! If not enough are available, short lengths of brass or iron pipe may be hung by thongs with the two bells already described. By cutting pipes to various lengths, any desired pitch can be obtained.

A good ear and a little imagination will help to audition household objects for sound effects. The microphone gives them their realism; unamplified they may not display their real character. All the effects depend on the mike, and in many cases on special placement of the mike. Once the ideal effect is produced, do not depend on getting exactly the same layout of mike and instrument, the same technique and the same amplification, at a future date when you may need it. *Record your effects*—then you will have them when you need them.

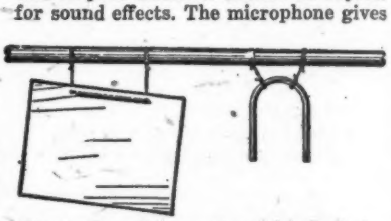


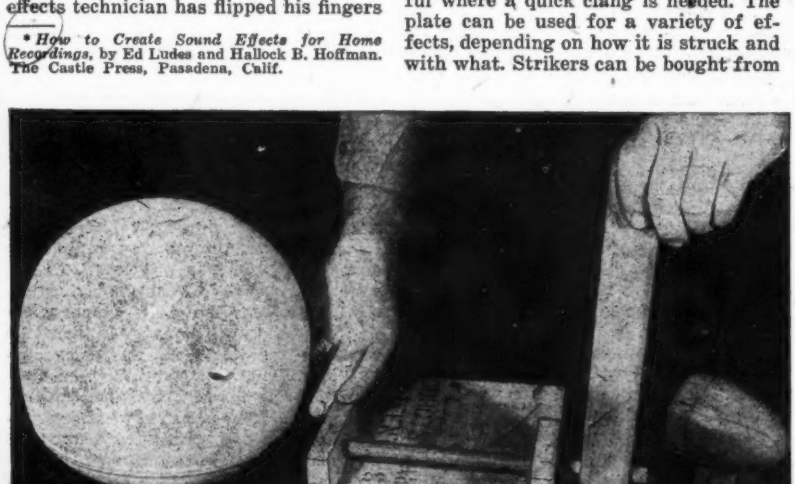
Fig. 2—Two of the most useful bell effects.

Squawks, squeaks, and gripes

Time was when the first sound heard when you turned on your radio was the opening or closing of a "screechy door."

Produced by the squeak board illustrated in Fig. 3 and one of the photographs, this equipment can be used also to imitate the creaking of a ship's timbers, rusty hinges, and other sounds. To build it, you need one board, ½ x 8 x 14 inches (plywood is best); one board, 1 x 2 x 20 inches; one piece of stock, 1 x 1 x 16 inches; one ½-inch dowel, 12 inches long; one 8/32 machine screw, 1½ inches long, with washer and screw to fit.

The drawing explains the construction. The trick is to drill the hole in C so the dowel fits tightly, and to drill the hole in D so it fits loosely. A nail is used to hold the dowel firm in C. Piece F is put on the dowel and turned till the saw-cut is up. The cut is filled with powdered rosin, and the board A rotated till the rosin is worked well into the dowel and its socket in F. Then the


At left is the "thunder ball," used also for explosions. The squeak board is seen at right.

*How to Create Sound Effects for Home Recordings, by Ed Ludes and Hallock B. Hoffman. The Castle Press, Pasadena, Calif.

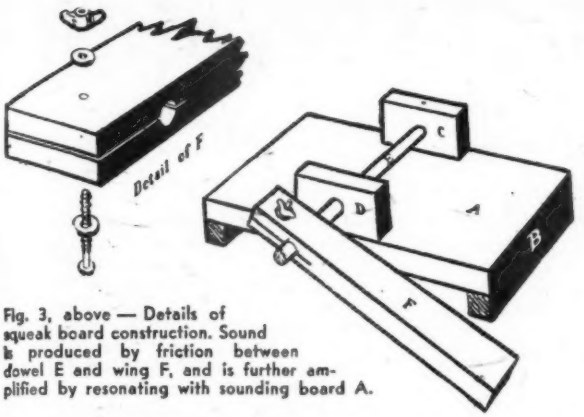


Fig. 3, above — Details of squeak board construction. Sound is produced by friction between dowel E and wing F, and is further amplified by resonating with sounding board A.

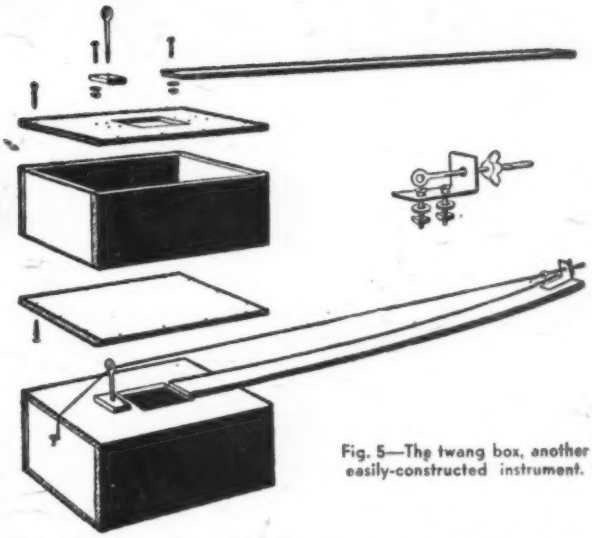


Fig. 5—The twang box, another easily-constructed instrument.

screw is adjusted for the desired range of notes.

An ear-splitting squeal can be made with the simple device shown in Fig. 4. The points of the nails should be bent forward *ever so slightly*—toward the point of the triangle. Put the block on a piece of glass at least 8 inches square, held off the table by a couple of strips under its edges. (The squeal-block can be used also on a window.) Try running

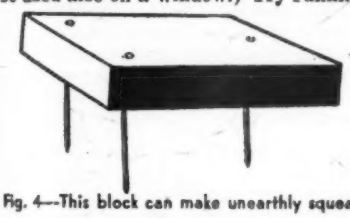


Fig. 4—This block can make unearthly squeals.

it over a smooth, unpainted piece of metal, for the squeal of automobile braked-skidding.

The twang or squeal box

The box of the instrument is 4 x 8 x 10 inches. The top is made of ¼-inch plywood; the remainder may be made of ½-inch wood or plywood. The neck is of ¼ or 3/16-inch plywood, 2 inches wide and 2½ feet long. The string is No. 8 piano wire. Fig. 5 explains all construction details.

To make squeaks, the string is bowed with a violin bow. The pitch is varied by pressing down on the end of the neck. Twangs are made by plucking the wire, tuning the string with the eyebolt at the end of the neck to produce a medium sound. For best results, the box should be secured to the table with a C clamp, which will leave both hands free to produce sound.

The twang box is well shown in the photo. Note especially the position of the mike, which is very important. With all sound effects, great variations can be produced by slightly changing the mike position. Experiment!

Other sound machines may be made very easily. Wind is produced with an electric fan motor and a block with 4 dowels inserted and firmly fastened into it. See Fig. 6.

To produce thunder or an explosion, use a half-teaspoon of BB-shot in a basket-ball bladder. This is shown in the photo of the squawk board. Hold the bladder between the hands and snap wrists sharply, so the shot is thrown from the bottom and then falls back on it. For an explosion, one snap will usually be enough. For thunder, snap, then roll the shot gently around the inside by tilting the bladder.

A rattlesnake also is imitated with BB-shot. Put about half a teaspoonful of shot in the cellophane wrapper of a cigarette package. Attach to the clapper of a doorbell (with the gong removed), and push the button.

A small chamois-skin sack of cornstarch is used to make footsteps in the snow. Hold the bag in both hands, near the microphone, and squeeze it with the thumbs, alternately, in walking rhythm. The effect is extremely realistic.

Rain is produced with a large piece of tissue paper, some scotch tape, a supply of salt or sugar, and two cardboard boxes. The drawing (Fig. 7) is completely self-explanatory. By making the tissue-paper slide flatter or steeper, the rain may be made hard or gentle. The steeper the slide, the faster the salt moves and the harder the rain seems.

For a railway locomotive, two blocks of wood, about 3 x 4 inches each, the surface of each covered with rough sandpaper, are used. Rubbing the faces together, close to the microphone, will produce a convincing train.

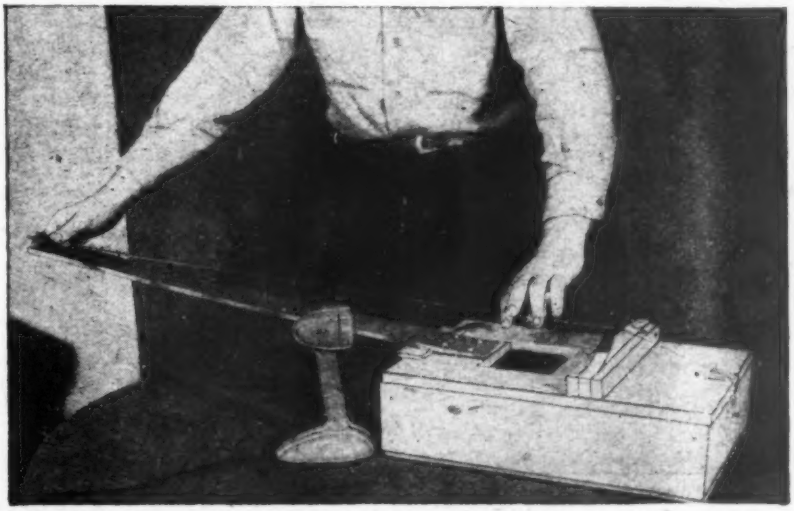
Fire is produced by twisting a piece of cellophane before the mike. Water, or waves, can be produced with another handful of BB-shot in a thin oval cardboard box such as a man's hat box. Hold the box at the ends and tilt it slowly so the shot rolls around on the bottom, near the outside edge.

Things are what they seem

An early sound-effects story tells of the attempts of one studio to imitate the sound of water being poured from a pitcher into a glass. The BB-shot could not produce a convincing sound. Crumpling a newspaper was no good. Everything in the sound-man's repertoire was tried without effect. Finally someone suggested pouring water from a pitcher into a glass . . . !

Here is a lesson for the amateur sound-effects man! Hammer a piece of board with an ordinary hammer, and you are carpentering. For sawing, use

(Continued on page 88)



Construction and use of the twang box can be easily understood from the photograph above.

SPEEDY A. C. - D. C. SERVICING

A few short-cuts in midget radio repair

By JOHN BOWLES

THE a.c.-d.c. radio is the most frequent visitor to the service shop. Not only is it the commonest type of radio, but many parts are often weakened by heat in the smaller and less well-ventilated a.c.-d.c. midgets.

The first cost of these sets is so low that the customer is unwilling to pay a great deal to have them repaired. The question then is: how can the serviceman make any money servicing these receivers?

The answer is—turn out more sets per day! Perhaps you are already turning out all you possibly can. But by using a few good short cuts, these small sets can really be serviced much faster.

The larger part of the time used in servicing a set is spent finding the trouble. Therefore the main concern is to locate the fault as quickly as possible. Then the job can be completed quickly.

Defective tubes cause the majority of a.c.-d.c. set failures. Burned-out filaments cause the most trouble. To find them—remove the chassis from the cabinet. Usually little can be done without this. Turn the bottom of the chassis up to get at the tube bases. Plug in the set and switch it on. The leads of an a.c. voltmeter capable of reading the full line voltage are placed across each tube filament in turn. (See Fig. 1.) When the voltmeter reads approximately full line voltage, it is across the open filament. Replace the tube.

This same test may be used for open ballasts or series line resistors.

In some cases the rectifier tube fails without the filament opening. Often this can be determined just by looking at the tube. A bluish or pinkish glow between the elements indicates a shorted filter condenser or an overload due to some other cause. Usually this has already damaged the tube.

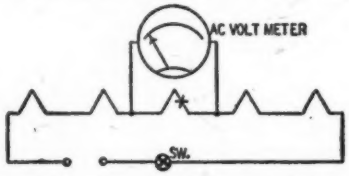


Fig. 1—A quick way to find an open filament.

Microphonic or noisy tubes can be found by tapping them lightly or they may be moved around slightly. If a blast of noise or a squeal is produced, it is best to replace with a new tube. Repeat the tapping or movement with the new tube. This tells the story quickly.

Filter condenser troubles

Faulty filter condensers come second in causing a.c.-d.c. set failures. Open condensers occur as frequently as shorted ones. If the set has a bad hum, chances are that one or more of the filters are open. The quickest way to check is to connect another condenser across the circuit. You know this method, of course. You also know that it is tedious. It is extremely hard to touch the correct points with the leads. They slip off, causing shock, or perhaps a disastrous short. This difficulty can be overcome by making a filter condenser test box. Five 8-μf. condensers are connected as shown in Fig. 2. A test cord is brought out with polarized markings. The capacities are additive by throwing the toggle switches, in steps of 8 μf.

Test first across the input filter. If the hum does not stop and the volume increase, try it across each of the other filters in turn.

If one part of a multisection condenser block is bad, it is always wise to replace the entire pack.

The quickest way to find a shorted filter condenser is to take an ohmmeter reading between the cathode of the rectifier tube and the chassis. A reading of less than 1,000 ohms would indicate that the filters were shorted. In some a.c.-d.c. sets the speaker field across the rectified voltage supply has a resistance as low as 1,000 ohms. For these sets this reading may be expected. The quickest way to find out which condenser is causing the trouble is to cut the positive leads, one at a time, until the ohmmeter reading increases.

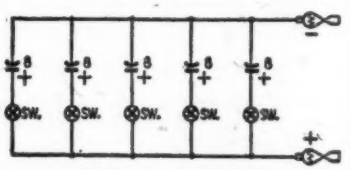


Fig. 2—Substitution box for filter tests.

Faulty paper condensers

By-pass condensers are another source of trouble in a.c.-d.c. sets. Placing another condenser across the suspected one, or across each one in the set, is slow. The job can be speeded up by using a by-pass condenser check box. Five condensers, with a selective switch and a pair of leads mounted in a small box can test the usual sizes. The capacities are .0001, .00025, .01, 0.1, and 0.5 μf. A rotary switch with at least 5 contacts is needed. The leads may be brought out to test prods or alligator clips. Refer to Fig. 3 for details.

This test box may be used to check capacities other than those contained in it. If a 0.25-μf condenser is to be checked, the 0.1- or 0.5-μf test condenser can be used. Results may not be perfect, but you can determine whether or not the condenser is open.

(Continued on page 77)

Test panel and service bench constructed by pupils of the Electric Shop, Dover (N.H.) High School. Power panel supplies 117 volts, 6 volts for farm and rural sets, and 2 volts.

ANTENNA PRINCIPLES

Part VI—Directive arrays with metal-screen reflectors

By JORDAN McQUAY

THE reflector elements considered in our previous article on the subject were single pieces of rod or tubing, dipole-like in construction and slightly longer than the radiating dipole.

A prominent characteristic of u.h.f. waves is that they are reflected by almost any type of metal screen, object, or surface. The metal functions much as an ordinary mirror when light waves impinge on it.

Thus, when desired, the dipole-like reflector element can be replaced by a metal screen or surface of suitable area, properly spaced behind the radiating dipole. Length of the metal screen or surface should be such that the reflector extends about a half wavelength beyond the extremities of the radiating

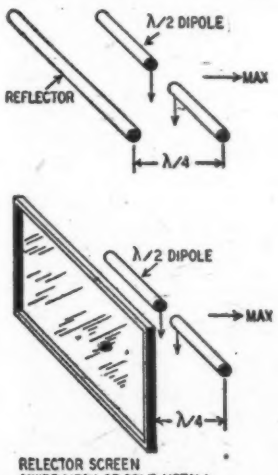


Fig. 1—The reflector may be a flat screen.

dipole. Height of the metal screen or surface is not critical, but should be at least half the length of the reflector. See Fig. 1.

At u.h.f. operating wavelengths of less than 1 meter, the metal reflector need not be a solid surface. It may be perforated with holes no larger than λ/8. Or the reflector may employ a screen of wire mesh, again providing that openings are no larger than λ/8. Many types of ordinary fencing material are satisfactory for the construction of reflectors for arrays.

Metal-screen reflectors are spaced in the same manner as the dipole-like reflectors. The reflectors are not connected to the electrical circuit, since their operation is parasitic in nature, as in the case of rod or tube reflectors.

Typical uses of metal-screen, wire, or mesh reflectors are shown in Fig. 1, and photos A, B and C.

Phased arrays

The simple horizontal arrays previously described provide various amounts of directivity of the field intensity pattern in the horizontal plane. The vertical plane also is unidirectional, but the pattern of radiation is extremely wide and not too useful.

Such arrays are adequate for low-power or limited-range applications, where extreme directivity in both horizontal and vertical planes is not required.

But for high-power operation, extreme directivity in both planes, and general increased efficiency—upright and much larger arrays (consisting of many radiating dipoles) are used for the transmission and reception of u.h.f. waves.

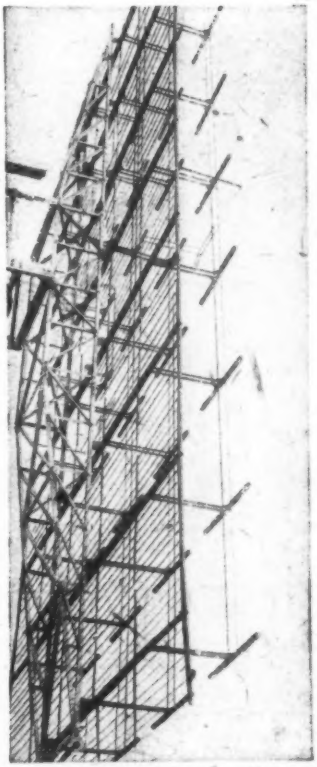
Included in this group of important microwave antennas are: The broadside array, the colinear array, the billboard array. Differences in the arrays are primarily those of arrangement and number of radiating dipoles.

In general, the half-wave dipoles are constructed of conventional metal rod or tubing. They may be center-fed or end-fed, but all dipoles must be fed in phase —by suitable spacing and arrangement of feed or transmission lines.

The dipoles are arranged within *the same plane* with respect to the earth. They may be stacked parallel, or mounted end-to-end. The position of all dipoles within that plane determines the polarization of the u.h.f. waves being transmitted or received. Horizontal polarization—used in most u.h.f. applications—is obtained by mounting the dipoles in a horizontal position. For vertical polarization, the dipoles are mounted vertically.

For unidirectional operation, individual and separate reflector elements can be used behind each radiating dipole.

It is more practical and efficient to use a reflector screen, particularly if there are a large number of dipoles. Such a nonresonant reflector is easier and cheaper to construct, and provides a better broad-band response than a resonant reflector.



Photos by U.S. Army Signal Corps

Photo A—Billboard antenna's screen reflector.

The wire mesh of the reflector is often made the main support of the entire array by mounting the radiating dipoles on quarter-wave metallic insulators which are short-circuited at the reflector screen. This rigidity of construction permits use of larger, heavier radiating dipoles—in turn providing oper-

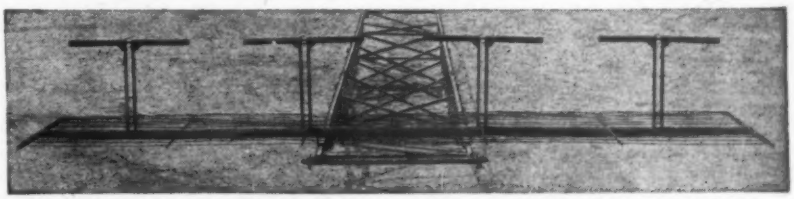


Photo B—A simple horizontal four-element colinear array with a wire-screen reflector.

Photo C—High-elevation 32-element billboard.

ation over a broader band of frequencies.

Directors are seldom used with large, phased arrays. This is mainly because of mechanical difficulties of construction. Any added benefit of directivity can be equaled—if not surpassed—by careful design and arrangement, spacing, and phasing of dipoles.

Broadside array

When any number of half-wave dipoles (or *pairs* of half-wave dipoles) are stacked one above the other in parallel, the result is known as a *broadside array*. It is essentially an arrangement in *height*, and may consist of two or more dipoles.

Vertical spacing between parallel dipoles should be close to a half-wave length. To preserve phase relationships without unnecessary lengths of transmission line, polarity is reversed between alternate dipoles as shown by antennas A and B in Fig. 2. Thus the array is fed with equal currents in the same phase.

The broadside array is used to obtain extreme directivity in the *vertical* field. Sharpness of the radiation pattern in the vertical plane is primarily a function of the number of stacked dipoles. The greater the number of dipoles, the greater the directivity in the vertical plane with no regard for the horizontal plane.

This relation is illustrated by antennas A and B and their relative radiation patterns in the *vertical* field, where antenna A provides greater directivity and greater power gain. This is an outstanding characteristic of the broadside array.

Colinear array

When any number of half-wave dipoles are placed end-to-end along a horizontal line, the result is known as a colinear array. It is essentially an arrangement in *width*, and provides extreme directivity in the *horizontal* field. Typical example of the colinear array is shown in Fig. 2.

Quarter-wave stubs are used between adjacent dipoles. Thus current is in phase in each radiating section of the array.

Sharpness of the radiation pattern is primarily a function of the number of half-wave radiating dipoles arranged in a horizontal line. The greater the number of dipoles, the greater the horizontal directivity—with no regard for the vertical directivity pattern.

This relation is shown in Fig. 2 by antennas C and D with their relative radiation patterns plotted in the horizontal plane, where antenna C provides greater directivity and consequent increase in power gain.

This is the outstanding characteristic of the colinear array.

Billboard array

When a considerable number of half-wave dipoles are arranged geometrically *both in height and width*, the result—a combination of the broadside and colinear types—is known as a *billboard array*.

It may consist of 4 *or multiples of* 4 dipoles. Some months ago when radar contact was made with the moon, Signal Corps engineers used a billboard array consisting of 64 half-wave dipoles. Another arrangement is shown in Photo B. In general, the greater number of dipoles in a billboard array, the greater the power gain and directivity.

Vertical spacing between parallel dipoles is about a half wavelength, and feed points along the transmission line (Fig. 2) are chosen to place the dipoles a half-wave apart. By reversing connections on alternate dipoles, they are effectively fed in phase.

The billboard array exhibits many directional characteristics of both the colinear and broadside arrays. It combines the directivity and power gain of antennas A and C—resulting in an extremely narrow, directional beam in the horizontal field of intensity. It also exhibits similar high directivity in the vertical plane. But, except for radar and certain types of navigational equipment, the horizontal field of intensity is of prime importance.

Feeder systems

Maximum efficiency of the u.h.f. antenna system requires a low-loss, nonradiating feeder system between the output of the transmitter and the actual antenna array and between the array and the input of the u.h.f. receiving equipment.

At fairly low frequencies in the u.h.f. band—from 300 to 600 megacycles—it is possible to use rigid, spaced, open-wire transmission line. Such feeder lines consist of metal tubing. They must be nonresonant, otherwise leakage current will damage the insulators.

Polystyrene can be used for all insulators, attached to the feeder line at voltage nodes. However, a much more satisfactory insulator is the metal stub support, or metallic insulator, which also helps keep the feeder line rigid. A stub support is a quarter-wave section of line, short-circuited at one end by any kind of metal frame or surface. The opposite end—connected to the line—represents a very high impedance. Thus no energy is lost through use of such an insulator at ultra-high frequencies.

The feeder line is matched to both antenna array and the transmitter output, with matching stubs placed anywhere along the feeder line.

The principal disadvantage of the open-wire feed line is a sporadic tendency to radiate because of the spacing between conductors. U.h.f. feeder lines must be nonresonant. The best remedy is to employ a concentric line or coaxial cable.

The concentric line may contain ceramic or polystyrene insulators between inner and outer conductors. Often the line is sealed shut after injecting an inert gas. This prevents collection of moisture inside the concentric line and thus raises the breakdown voltage.

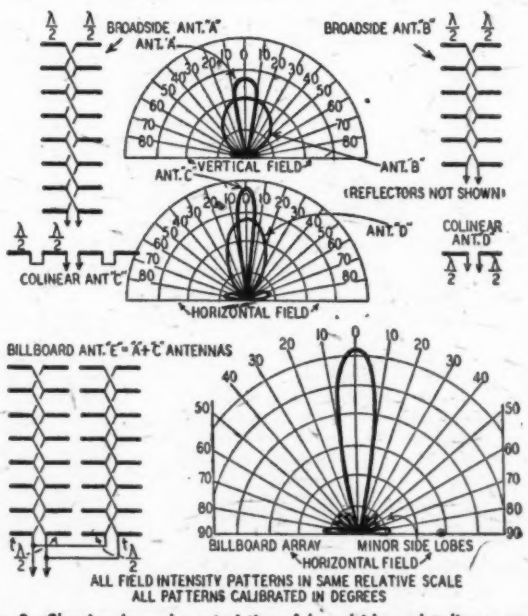


Fig. 2—Showing how characteristics of broadside and colinear arrays are combined in the billboard to give excellent sharpness and gain.

A SMALL RECORDING STUDIO

Part III—Cutters, volume level indicators and compensation circuits

By J. C. HOADLEY

WITH the equipment described in Part I of this article on hand, it is necessary to connect the different units in such a way that a maximum of fidelity and utility may be obtained.

Fig. 1 is a block diagram of a typical recording layout. This is a basic setup which may be added to from time to time. It consists of several studio microphones, a recording amplifier with level indicator and monitor speaker (or phones), dual recording tables with playback pickups, a high-quality playback speaker, receiver, and switches to perform the switching operations required for maximum usefulness.

The most important considerations are to connect the cutters to the amplifier properly and to connect—between the cutters and the amplifier—suitable networks which control the cutter's characteristics in order to provide the best possible recording.

First, it is necessary to match the impedance of the cutter so frequency response will be smooth and distortion low. There are several types of recording heads and their connections vary. If you have chosen a crystal type, you can connect it to the amplifier in various ways. We will assume the use of a push-pull recording amplifier, as it is markedly better than a single-ended one for recording and not much more expensive. We will further assume the use of either triodes or beam tetrodes with sufficient negative feedback as output tubes.

Connecting the cutter

Fig. 2 shows two methods of connecting a crystal cutter. For a constant-amplitude recording characteristic, we omit Rx or Ry, because the crystal cutter has a uniform stylus displacement with constant applied input voltage within its frequency range. It is necessary, with a conventional crystal cutter such as the Brush RC-20, to reflect not over 4,000 ohms to the cutter. It is desirable to reflect a lower impedance, of the order 2,500 to 3,000 ohms. This happens to be the plate-to-plate output impedance of push-pull 2A3's, so we do not need a special output transformer for these tubes. We can connect the cutter as shown in Fig. 2-a.

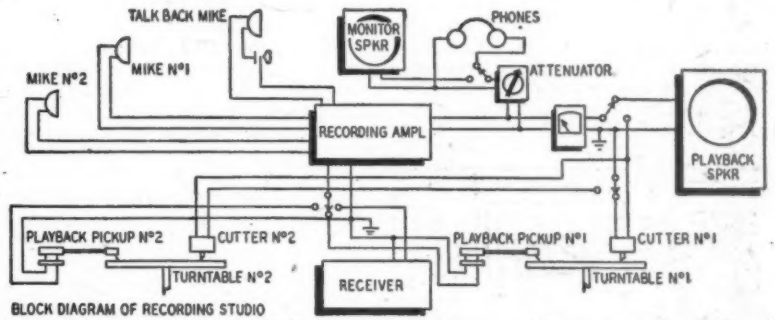


Fig. 1—Block diagram of a recording studio with sufficient equipment for professional work.

To cut commercial modified constant-velocity recordings (similar to shellac pressings), we must insert Rx in Fig. 2-a. As the crystal presents a capacitive impedance, this constitutes an RC network. Voltage across the crystal will decrease with frequency above a certain turnover frequency. This frequency will be determined by Rx and the crystal's capacity. The RC-20 crystal's internal capacity is 0.007 μf at 100 cycles. Therefore, for this type crystal to provide a turnover frequency of 500 cps, in Fig. 2-a Rx would equal 44,000 ohms. For other turnover frequencies, consult the Brush technical bulletin No. 291 which is supplied with this cutter.

In Fig. 2-b, the transformer T2 matches the crystal to a 500-ohm line, and for constant amplitude recording should have a secondary impedance of 3,000 to 4,000 ohms. For a commercial constant-velocity recording characteristic with a turnover frequency of 500 cps, the transformer should have a secondary impedance of 22,000 ohms and Ry also should have a value of 22,000 ohms.

These recording characteristics may

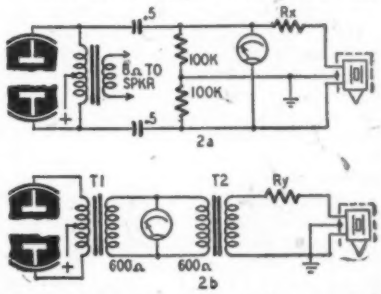


Fig. 2—How crystal cutter may be connected.

be modified for special purposes by varying the frequency response of the recording amplifier with frequency controls or external equalizers. It is conventional to emphasize the high-frequency response in constant-velocity recording. The high frequencies are

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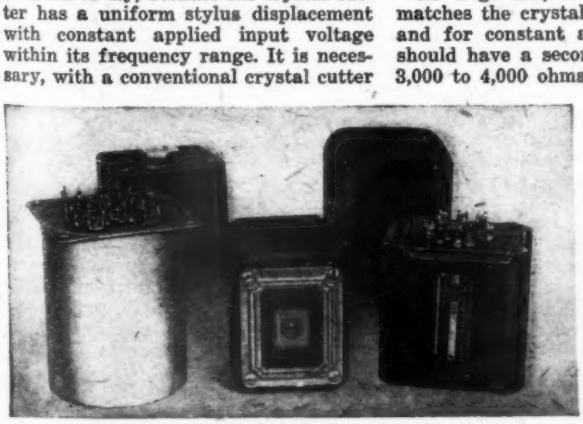
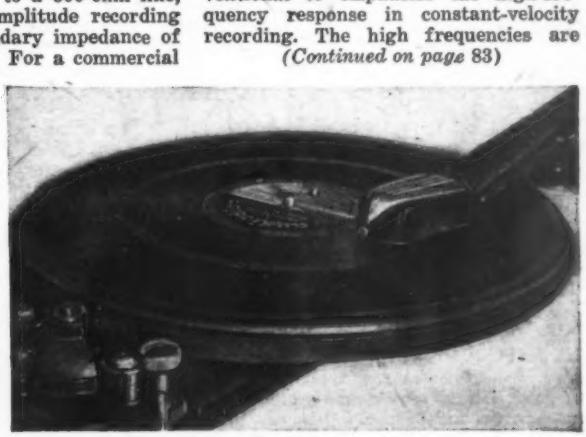




Typical specimens of high-quality recording and playback apparatus.

TELEVISION FOR TODAY

Part XII – High and low-voltage power supplies

By MILTON S. KIVER

A TELEVISION receiver, because of its construction, requires two types of power supplies. All the tubes, with the exception of the cathode-ray tube, are low-voltage units. Hence, all of these circuits can be bunched together and supplied from the same source. This is generally a conventional power supply capable of supplying the required current. A commercial unit is shown in Fig. 1.

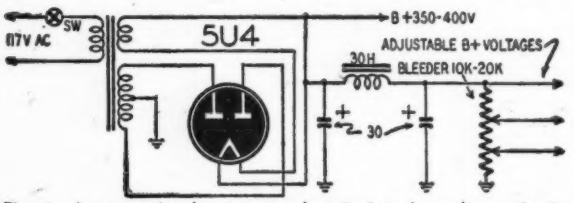


Fig. 1—A conventional power supply suited to low-voltage circuits.

The high-voltage unit must be capable of supplying 5,000 to 7,500 volts. However, the current drain is extremely small—generally not more than 750 microamperes. This permits modification of the component values in the high-voltage unit to result in a relatively small and compact assembly. Fortunately, the small current drain permits the use of half-wave rectification with very little filter difficulty.

Filtering is accomplished by a "brute force" unit (one with large series elements and relatively small shunt condensers). When the voltage reaches the values called for in television, extreme care must be exercised that the energy in the filter condensers does not exceed 1 joule, since this is sufficient to kill most people on contact. Energy storage varies directly with capacitance; consequently, the smaller the capacity, the better. The smaller capacitance is also economical. However, filtering ability of a condenser decreases directly with decreasing capacity. Hence, a compromise value is used. A typical high-voltage circuit is shown in Fig. 2.

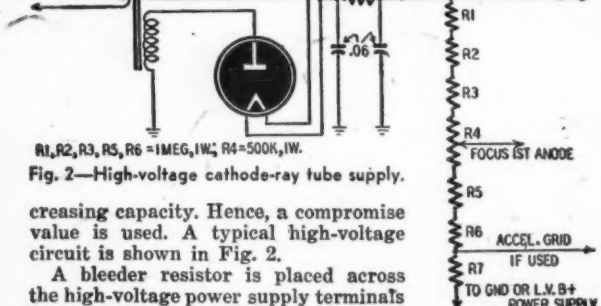


Fig. 2—High-voltage cathode-ray tube supply.

A bleeder resistor is placed across the high-voltage power supply terminals for two reasons. First, it permits tapping off voltages for the focusing (first) anode and the accelerating electrode. Second, *it discharges the condensers when the set is turned off.* Since the voltage is high and the current low, the bleeder resistance must be high. Values between 4 and 10 megohms are normal. The low current drain permits the use of 1-watt resistors, at 1 and 2.2 megohms. The resistors are series-connected, as in Fig. 2, and taps or suitable potentiometers are inserted at the appropriate voltage points.

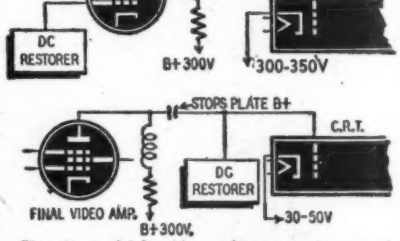
The only difference between a high-voltage supply designed for electrostatic deflection tubes and that used for electromagnetic deflection is in the centering system which must be provided for the deflection plates. The necessary circuit was shown in the preceding article of this series. These controls are placed as close to the second anode potential as possible, since the deflection plates are physically located near the second anode in the cathode-ray tube. A large difference in voltage between the deflection plates and the second anode would slow down the electrons in the beam and distort the image.

The centering controls provide a method of varying the d.c. voltage between the two plates of each set. The electron beam, in passing between the plates, is subjected to the electric field caused by the voltage difference and shifted accordingly. If the electron beam does not require this additional shifting in order to reach the center of the screen, the centering voltage can be reduced to zero volts difference *between* the plates. Note that the centering is accomplished by the voltage difference between each set of plates and not by the polarity or value of this voltage with respect to the cathode.

In electromagnetic deflection, the centering controls receive their voltages from the low-voltage power supply. By controlling the amount and direction of the current through the coils, we can alter the position of the beam as it appears on the screen.

One final word about the power supply of Fig. 2. Many manufacturers connect the negative end of the high-voltage supply to some positive point on the low-voltage unit, instead of directly to ground. As a result of this connection, every point on the high-voltage unit is raised by an amount equal to the potential at the point of attachment. Why this is done can be understood best by reference to Fig. 3.

In Fig. 3-a, the control grid of the cathode-ray tube is directly connected to



Figs. 3-a and 3-b—How voltage may be gained attaching to positive of low-voltage supply.

the plate of the final video amplifier. This places a high positive voltage on the grid of the cathode-ray tube and necessitates an even greater positive voltage on the cathode. The positive voltage on the control grid comes from the low-voltage power supply. The required positive voltage for the cathode can come either from the low-voltage supply, or by tapping up on the high-voltage bleeder chain. If we tap up on the high-voltage bleeder chain, we decrease the positive potential of each of the other elements in the cathode-ray tube. The effective voltage of these other elements is measured from the cathode of the tube, not ground. Hence, in this latter method, two hundred to three hundred volts of the high-voltage supply is used only to counteract the positive control-grid voltage and not for accelerating the electron beam.

If we connect the negative end of the high-voltage unit to the B-plus of the low-voltage supply, then the cathode can be placed at the lowest point in the high-voltage bleeder chain, or even at some lower positive voltage in the low-voltage unit. This permits complete utilization of the high voltage.

If the control grid is not subjected to the d.c. potential of the preceding video

(Continued on page 50)

Multi-Station Intercoms

Part III – Intercom installation and maintenance

By RICHARD H. DORF

IN the last two articles we discussed the construction of two types of intercommunication master stations and three types of switching systems. This part will deal with the problems of installing and maintaining intercom networks.

Whether custom-built units or factory-built commercial jobs are to be used, the initial step is to appraise the requirements of the particular installation. Each user's needs should be carefully tabulated.

The principal question is whether to use a master-to-master or a master-to-remote system. In installations which consist of only two stations, this problem answers itself, since it would be foolish to use two masters. In other cases there is always the consideration of cost versus utility.

In a home, for example, where a person in any room may want to call a person in any other room, the master-to-master system is almost obligatory. If the user wants communication only between each of several master bedrooms and the kitchen, however, the less expensive master-to-remote setup can be used, with the master in the kitchen.

In a typical factory installation, the production manager may want to be able to call each of several assembly rooms; that would permit use of the cheaper intercom system. But if communication were needed among several executives, master-to-master would be indicated.

Where master-to-master is decided upon, a choice must be made—where the custom-built units are used—of either the 3-tube or the 1-tube master. Either will perform very satisfactorily, and in operation there is no difference. However, with the 1-tube masters, failure of any station amplifier will incapacitate that station entirely. With the 3-tube amplifier the station will still be able to hear calls, even though its amplifier is dead. In this case, the choice is one of price versus reliability.

It is always necessary to confer with the buyer of the system, to explain all these factors, and then to base the final choice upon his informed decision.

The next consideration is the physical layout of the area to be covered. Fig. 1 shows block diagrams of an installation with five stations. Examination will show that Fig. 1-a obviously uses less connecting cable. The installation shown in Fig. 1-b would be justified only if some barrier such as a stone wall, body of water, etc., prevented the more economical cabling route.

The usual method of connecting each station to the cable is through a junction box. A standard black-crackle finish steel box, 4 x 4 x 2 inches, was conveniently made into such a junction box (see drawing). A terminal strip with the required number of lugs (1 more than the total number of stations) is fastened to the inside of the box. The holes required for entry and exit of the cable are made, and the box is screwed to the baseboard as near as possible to the location of the station unit.

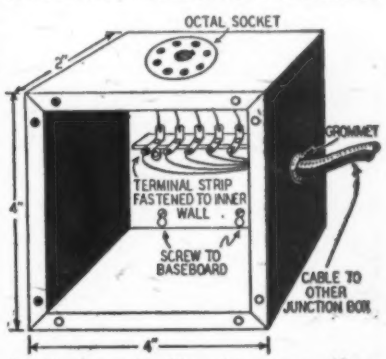
In the box pictured, a standard 8-contact tube socket is mounted in the upper wall. Under the chassis of the station unit is a 6-lug terminal strip, to which one end of a 6-wire cable is soldered. The other end is soldered to an 8-prong plug, which fits into the junction-box socket. The socket is wired to the junction-box terminal strip, as is the cable which runs between stations. With this arrangement, the station unit can be removed for cleaning or repair by simply pulling out the a.c. plug and the cable plug. No unsoldering or tampering is necessary.

Another factor which makes the use of junction boxes almost imperative is the difficulty of cutting into or splicing multiwire cables. A junction box should be used at any place in the system where the cable must be tapped. It is entirely practical—as an alternative—to mount a socket on the rear apron of the amplifier chassis and plug a cable from the junction box into that. The difficulty is that the plug will usually jut out unpleasantly from the rear of the cabinet.

Richard H. Dorf was born in New York City in 1921. Being thrown several feet after inserting a hairpin in the a.c. wall socket at the age of 5 started his interest in electricity. Progressed through model train control systems and model stage set lighting setups to audio amplifier construction. Has been announcing and handling programs at New York radio stations since the age of 17. Spent 3½ years in the Air Forces as communications officer, teaching radio and maintaining airborne v.h.f. equipment. Now is programming FM station WMGM.

About eight hours a day are spent on his hobbies, audio, radio, and good music. Specializes in the design and construction of audio equipment, including recording systems, but creates a bit of r.f., too, now and then, with the call W2QMI.

Several manufacturers make intercom cable with almost any desired number of conductors. This cable is color-coded



Junction boxes simplify maintenance problems.

(a necessity) and usually cloth-insulated. It is very satisfactory for all indoor installations, but actually *any*

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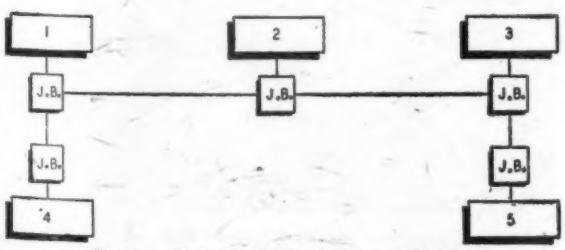


Fig. 1-a—Economically-wired intercom system.

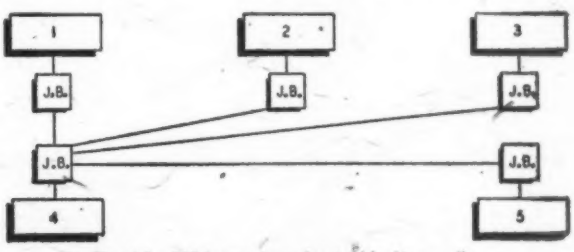


Fig. 1-b—Wiring system due to blocking walls.

Canberra's Mobile Radios

Firemen and plumbers respond to radio calls

Central control station of Canberra's municipal mobile radio net.

SOMETHING has gone wrong with the main fuses in your house. You report to the electricity people by 'phone, and almost before you've had time to put the instrument down, there's a ring at the door, and a man has come to do the job.

It sounds like a housewife's dream, doesn't it? But in Canberra, Australia's planned capital, it often happens. And not only with the electricians, but with the plumber and the ambulance, the police and the men who repair refrigerators and other mechanical appliances.

The Government department that is landlord of most of Canberra's houses and which provides all the normal services, uses radio communication with its service vehicles just as police departments do in other cities. An electrician, for instance, who has just finished a job, doesn't go straight back to his base. He tunes his radio to find out if there's another job in the immediate neighborhood. The department has been astonished to find how often there is.

It all came about because of the big forestry projects that have their headquarters in the capital. The country round about is wild and set among rugged hills, and it was difficult for forestry patrols to keep in touch with each other and with their base.

Readymade sets lacked power

R. G. Fowler, radio engineer to the department, fitted up a few cars with small imported commercial sets, and the problem was solved. There was only one difficulty. The little sets had a short range and the patrols worked over wide areas, so cars were often out of range of the base station. Because of war demands, no further units were obtainable. Fowler set about designing and making his own.

The result was even better than he had expected. His sets, although worked off car batteries with vibrator units, and not much bigger than a car radio, had a range that far exceeded anything that could have been bought. Forest patrols often speak to each other across forty-mile skyline distances, over thickly-wooded hilly country, unfavorable for radio communication.

Shortly after the successful trials of the first sets, the department realized that radio control could be usefully applied to all the ordinary services. After the road and bridge maintenance cars had been fitted, Fowler turned to the water and sewerage services, and the electrical and mechanical fitters.

Now the police, fire brigade and ambulance services are having their turn, and soon every emergency that can happen to Canberra people will be dealt with swiftly and efficiently by radio. Incidentally, the department has found that by being able to go straight to his next job, the average serviceman saves as much as forty miles of driving each day.

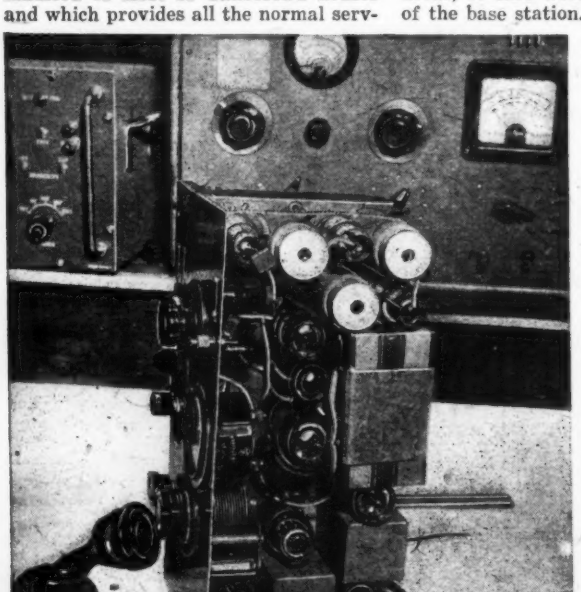
Ordinary citizens have also had reason to be glad of the service. Recently some hikers were lost for days in the densely wooded country outside the capital. When they were eventually found by airplane, the pilot radioed messages that were relayed to forestry cars working in the vicinity. The wanderers were soon picked up. Had it not been for speedy radio service, help might have arrived too late.

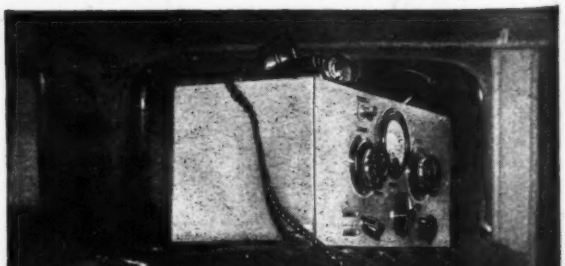
Radio electrician's helper

Some weeks earlier, an electrical maintenance man, installing a wind-powered battery charger up on the Bag Range, damaged some of his essential equipment in an accident.

Bag Range is a wild place, almost inaccessible, and to reach it, he'd been obliged to transfer all his gear, including the radio, on to a mule-drawn sledge, and drag it for miles. The sledge capsized and all his equipment rolled down

(Continued on page 75)





Above—The large transceivers are conveniently installed as shown. Left—Top view of transceiver unit. The B-battery is inside the case.

WORLD-WIDE STATION LIST

Edited by ELMER R. FULLER

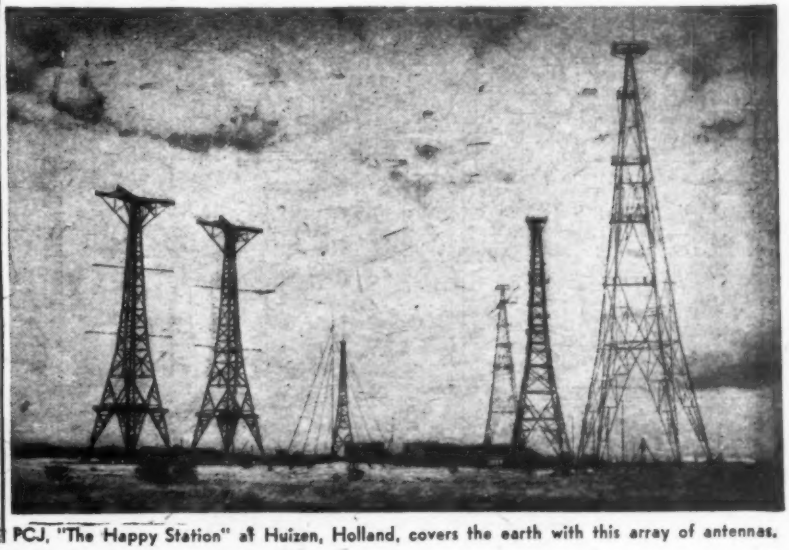
CONDITIONS have been improving in the past few months and perhaps some good dx will be heard one of these days. Sun spots have been bothering at times, but there have been a few good days. The Australians have been heard very fine business on 15.200 mc from 0200 to 0400 hours EST; and in foreign-language broadcast on 15.230 mc and 15.310 mc from 0230 to 0345 hours. Ponta del Gada in the Azores is being heard from 1700 to 1900 hours on 4.845 mc and puts in a very good signal, on this new frequency. PGD in the Netherlands gives the news in English at 2300 hours except Saturday on 6.020 mc. Ceylon is still being heard Sundays from 1330 to 1530 hours to England on 7.190 mc, coming in at a very convenient time.

Dx on the ham bands has also been very good at times. Several countries have been heard on 10 and 20 meters including G6WT in England, as well as G2MF, G2BB, G3BK, G3IY and G8JB. From Scotland GM8MN and GM4AN. Denmark was heard via OA6PX. Several hams have been heard from Germany on 10 but notably D4ACD, who seems to be on most of the time. PAHS has also been heard several times from the Netherlands as was LA4FB from Norway. D4ARN is also heard often from Germany. On 20 meters we have numerous reports of the following: G6BY and G6AY from England; XE1A and XE1CK from Mexico; EI6G from Ireland; VO2AF from Newfoundland; YV5ADX and YV5AE from Venezuela; HK3BF from Colombia.

Listening Post Certificates will be in the mails by the time that you have read this, but more observers' services could be used. We never can have too many reports. The more we have, the better picture of conditions we can print. Send your requests for further information to the Shortwave Editor, c/o RADIO-CRAFT, 25 West Broadway, New York 7, New York. We would especially like to hear from oms, yls, and xyls from overseas. So until next month, best of luck and lots of fb dx. All time is given in 24-hours EST.

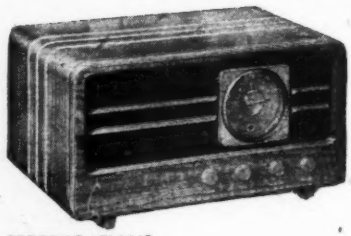
Location	Station	Freq.	Schedule
ALASKA	WXFD	13.250	1800 to 0100
ALBANIA			
Tirana	ZAA	7.850	1400 to 1800
ALGERIA			
Algiers		6.040	1230 to 1800
Algiers		9.540	1230 to 1700
Algiers		11.830	0030 to 0300; 1200 to 1800
ANDORRA		5.980	0500 to 1900
ANGOLA			
Benguela	CR6RB	9.160	1330 to 1430
Luanda	CR6RA	9.470	0115 to 0230; 0630 to 0745; 1400 to 1530
ARGENTINA			
Buenos Aires	LRS1	5.980	1800 to 2300
Buenos Aires	LRY1	6.090	0545 to 0715; 1800 to 2100
Buenos Aires	LRY1	9.680	1600 to 1630
Rosario	LRR	11.880	0600 to 1800
AUSTRALIA			
Brisbane	VLQ2	7.210	0230 to 0830
Brisbane	VLQ	7.240	1500 to 1900
Melbourne	VLQ	9.580	1100 to 1200
Melbourne	VLG3	11.710	0100 to 0145; 0230 to 0345
Melbourne	VLA4	11.770	1100 to 1200; 1530 to 1830; 2345 to 0045
Melbourne	VLG6	15.230	2100 to 2300
Perth	VLW7	9.520	0530 to 1030; 1700 to 2045
Shepparton	VLC8	7.280	1015 to 1045
Shepparton	CLR	9.540	1620 to 1900; 2045 to 0220
Shepparton	VLC6	9.610	0830 to 1200
Shepparton	VLB2	9.680	0900 to 1100
Shepparton	VLC7	11.840	0800 to 0915
Shepparton	VLC4	15.310	N. American beam, 2045 to 2145; 0010 to 1145; Asiatic beam, 1730 to 1800; Philippine beam, 1900 to 1915
AUSTRIA			
Vienna		7.160	0000 to 0200; 0600 to 0800; 1000 to 2030
Vienna		9.820	2345 to 2030
Vienna		12.210	1145 to 2030
AZORES			
Ponta del Gada		4.040	1700 to 1900
Ponta del Gada		11.090	1500 to 1600
BELGIAN CONGO			
Leopoldville	OTC	9.380	0000 to 0200; 1045 to 1600
Leopoldville	OTC	9.740	1300 to 2015
Leopoldville	OTC	11.720	0530 to 0730
Leopoldville	OTC	17.770	0500 to 0930; 1130 to 1215
BOLIVIA			
Cochabamba	CP40	6.510	1930 to 2200
Lapaz	CP49	6.770	0700 to 0900; 1100 to 1200; 1730 to 2100
BORNEO			
Balikpapan		9.120	0700 to 0935
BRAZIL			
Belem	PRC5	4.860	0600 to 1100; 1530 to 2000
Fortaleza	PRE9	6.100	1530 to 2100
Rio de Janeiro	ZYC8	9.610	1500 to 2200
Rio de Janeiro	PRL7	9.720	0430 to 0600; 1415 to 1445; 1500 to 2100
Rio de Janeiro	PSH	10.220	1700 to 1800
Rio de Janeiro	PRL8	11.720	heard at 0500
Sao Paulo	ZYB7	6.090	1600 to 1950
BRITISH GUIANA			
Georgetown	ZFY	6.000	0545 to 0745; 0945 to 1145; 1415 to 1945
BRITISH SOMALILAND			
Hargeisha		7.130	0800 to 1030; 1200 to 1300
BURMA			
Rangoon		6.010	0030 to 0230; 0645 to 0830; 2100 to 2145
CANADA			
Calgary	CFYP	6.030	0730 to 0100
Edmonton	CJCA	9.540	0815 to 0200
Montreal	CFCX	6.000	0700 to 2315
Montreal	CBFW	6.090	0730 to 1945; 2000 to 2400
Montreal	CKLO	9.630	1600 to 1800
Montreal	CKCX	15.190	0800 to 1200
Montreal	CKNC	17.820	0830 to 1500
Toronto	CFRX	6.070	0600 to 2345
Vancouver	CKFX	6.080	0930 to 0300
Vancouver	CBRX	6.160	0800 to 0200
Winnipeg	CJRO	6.150	2200 to 0300
Winnipeg	CKRX	11.720	1000 to 2000
CANAL ZONE			
Quarry Heights		2.390	0530 to 0700; 1000 to 2305
CANARY ISLANDS			
Santa Cruz	EAJ43	7.570	0630 to 0800; 1100 to 1200; 1230 to 1800
CEYLON			
Colombo		3.390	0600 to 1200
Colombo		6.070	0715 to 1200; 1930 to 0545
CHILE			
Santiago	CE1174	11.740	1700 to 2400
Santiago	CE1180	12.000	0600 to 0800; 1600 to 2300
CHINA			
Canton	XTPA	11.650	0400 to 0915
Chungking	XGOY	7.150	0630 to 1130
Chungking	XGOY	9.650	0630 to 1030
Chungking	XGOA	9.730	0900 to 1030
Chungking	XGOY	11.900	0500 to 0630; 1045 to 1145
Geochow	XGOL	10.000	0400 to 1000
Kweiyang	XPSA	7.010	2330 to 0030; 0430 to 0900
Shanghai	XGRS	11.690	0300 to 0930; 1830 to 2400
COLOMBIA			
Armenia	HJFH	4.880	0600 to 2200
Barranquilla	HJAB	4.780	1700 to 2255
Bogota	HJCA	4.850	1900 to 2200
Bogota	HJCH	4.890	1800 to 2200
Bogota	HJCW	4.940	0645 to 1115; 1600 to 2315
Bogota	HJCQ	4.950	1000 to 1400; 1700 to 2330
Bogota	HJCX	6.020	0700 to 0800; 1400 to 2315
Bogota	HJCD	6.160	0700 to 0800; 1600 to 2330
Bogota	HJCT	6.200	1000 to 1400; 1800 to 2315
Bogota	HJCF	6.240	1700 to 2360
Cartagena	HJAP	4.920	0600 to 1300; 1700 to 2200
Cartagena	HJAE	4.960	1600 to 2230
Cali	HJED	4.820	1900 to 2300
Cucuta	HJBB	4.810	1700 to 2200
Medellin	HJDE	6.140	1100 to 2300
COSTA RICA			
San Jose	TIRH	6.150	2130 to 2400
San Jose	TIPG	9.610	0700 to 2330
CUBA			
Camaguey	COJK	8.720	2000 to 0030
Havana	COBZ	6.040	0800 to 2300
Havana	COCD	6.130	0700 to 2400
Havana	COCW	6.330	0600 to 2400
Havana	COCO	8.700	0700 to 2330
Havana	COCQ	8.830	0530 to 0030
Havana	COBZZ	9.030	0700 to 0100
Havana	COBQ	9.230	0800 to 1200; 2000 to 2200
Havana	COCX	9.270	0700 to 0030
Havana	COBC	9.380	0700 to 2400
Havana	COBL	9.820	0715 to 0045
Havana	COCY	11.740	0630 to 0100

(Continued on page 79)



PCJ, "The Happy Station" at Huizen, Holland, covers the earth with this array of antennas.

RADIO DATA SHEET 346



GENERAL ELECTRIC FARM RADIO

MODEL 280

SPECIFICATIONS

OPERATING FREQUENCIES:

Broadcast Band	540-1710 kc.
Shortwave Band	5.8-18.3 mc.
I.f. Amplifier	455 kc.

POWER OUTPUT:

Undistorted	0.15 watt
Maximum	0.27 watt

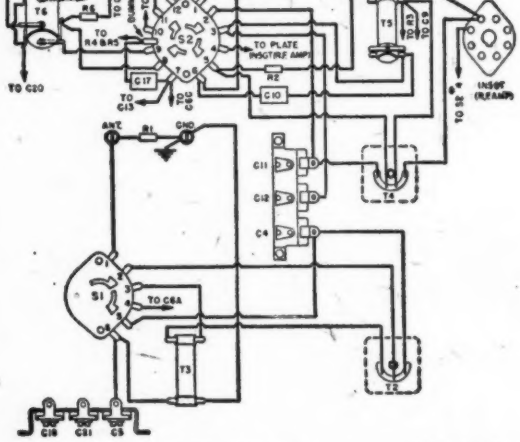
R.F. STAGE GAINS:

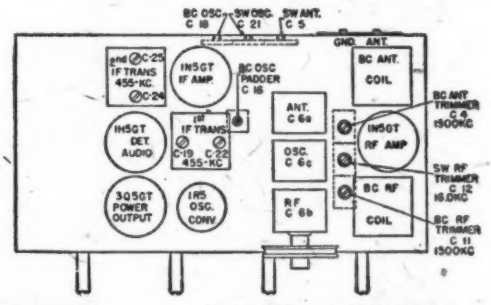
Antenna post to 1N5-GT r.f. grid	3 at 1000 kc.
1N5GT r.f. grid to 1R5	10 at 1000 kc.
1R5 grid to 1N5-GT i.f. grid	46 at 1000 kc.
1R5 grid to 1N5-GT i.f. grid	60 at 455 kc.
1N5-GT grid to 1H5-GT i.f. diode plates	80 at 455 kc.

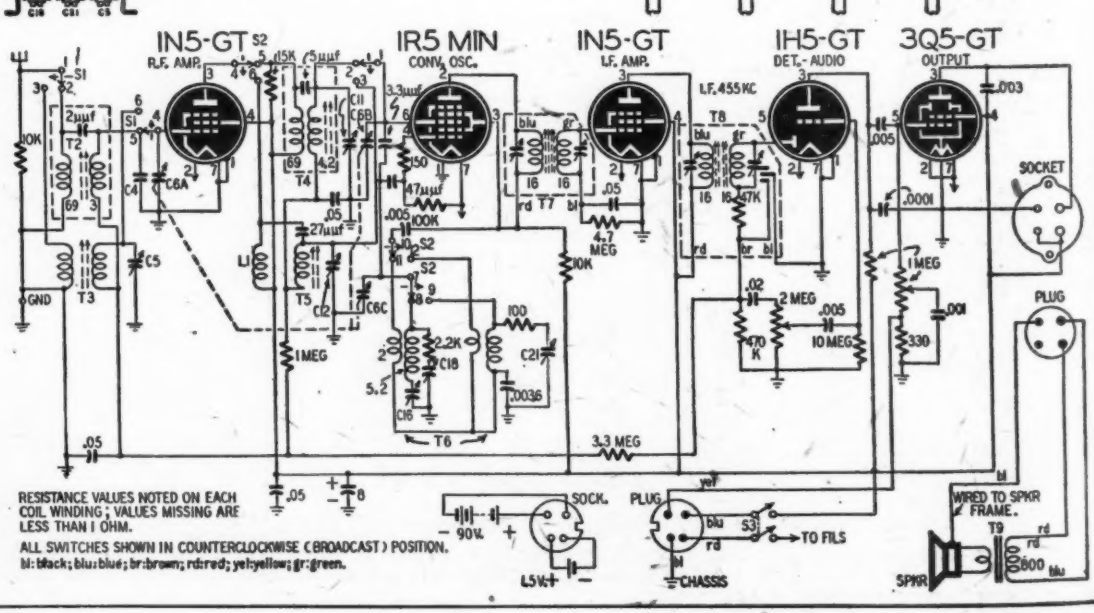
ALIGNMENT CHART

Step	Connect Test Oscillator To	Test Oscillator Setting	Pointer Setting On Radio	Adjust For Max. Output
1	1N5GT r.f. grid in series with .05 mfd.	455 kc	"BC" Band 550 kc	1st i.f. transformer trimmers
2	1R5 conv. grid in series with .05 mfd.	455 kc	"BC" Band 550 kc	2nd i.f. transformer trimmers
3	1N5GT r.f. grid in series with .05 mfd.	1710 kc	H.f. End	C18 (osc.)
4	1N5GT r.f. grid in series with .05 mfd.	1500 kc	1500 kc	C11 (conv.)
5	1N5GT r.f. grid in series with .05 mfd.	600 kc	600 kc	* **C16 (osc. padder)
6	Antenna Post in series with 200 mmf.	1500 kc	1500 kc	C4 (r.f.)
7	1N5GT r.f. grid in series with .05 mfd.	18.3 mc	H.f. End	C21 (osc.)
8	Antenna post in series with 400 ohms	16.0 mc	16.0 mc	* C12 and C5 (Conv. and r.f.)

*Rock gang condenser when making alignment.
**Repeat steps 3 and 4 for best results.







RESISTANCE VALUES NOTED ON EACH COIL WINDING; VALUES MISSING ARE LESS THAN 1 OHM.

ALL SWITCHES SHOWN IN COUNTERCLOCKWISE (BROADCAST) POSITION.

bl: black; blu: blue; br: brown; rd: red; yel: yellow; gr: green.

Start Your Own RADIO SERVICE SHOP

Choose one of these 3 GREAT NEW DEALS

$99.50

$179.50

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Includes TEST EQUIPMENT, TUBES, PARTS, TOOLS

3 complete going-in-business packages. (If necessary they can be changed to suit your needs.)

There never was a better opportunity than now to start a profitable business of your own. No fuss, no worry. Here's everything you need. Details upon request. Write, wire or phone!

Featherweight Miniature TEST INSTRUMENTS

Compact — Accurate — Priced Right!

- **Jeweled Meter • Range Selector Switch**
- **All multipliers bridge tested for 1% accuracy**
- **Zero adjustment—built in batteries**
- **Molded bakelite case only 3-15/16" x 2-7/8" x 2"**

MODEL 450A
Volt—Ohm—Milliammeter

A fine instrument having a sensitivity of 1000 ohms per volt.
Ranges: Volts DC, 0-5/10/50/500/1000;
Mills DC, 0-1;
Ohms full scale, 0-5000/50,000/500,000;
Ohms center scale, 30/300/3000.

NET complete with batteries **10.90**

MODEL 451A AC-DC
Volt—Ohm—Milliammeter

A dependable instrument of wide utility—sensitivity 1000 ohms per volt.
Ranges: Volts AC, DC, and Output Ranges, 0-10/50/100/500/1000;
Ohms full scale, 500,000.
Ohms center scale, 7200.

NET complete with batteries..... **14.90**

MODEL 451B

Same instrument as above but has 2500 ohms per volt sensitivity.

NET complete with batteries..... **16.60**

MODEL 452A
Volt—Ohmmeter

A superb instrument—100 microampere meter gives 10000 ohms per volt sensitivity.
Ranges: Volts DC, 0-10/50/100/500/1000;
Ohms full scale, 0-2000/20,000/200,000/2 Megs;
Ohms center scale, 30/300/3000/30,000.

NET complete with batteries..... **14.90**

MODEL 312
Volt—Ohm—Milliammeter

An economy pocket meter featuring a 2" moving vane meter.
Reads: AC-DC volts, 0-25/50/125/250;
Mills AC-DC, 0-50;
Ohms, 100,000;
mfd. .05-15.
Jacks provide range selection.

NET Complete with cord and plug..... **6.75**

TEST LEADS (Removable Needle Points).....**.59**
Excellent for above instruments.

TURNTABLE STAND

$3.91

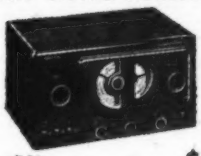
With each stand we send a stroboscope free.

All steel—adjustable—holds turntable 18" above bench—tilts to any position—speeds work—saves time—prevents damage to parts—pays for itself on first job—you need several at this low price.

PHILCO BEAM OF LIGHT

Selenium cell only, no holder, postpaid... **$1.80**
(Puts new life into Philco Changers)
Sapphire needle only, no mirror, postpaid **$1.20**

SHORT WAVE RECEIVERS



Hallicrafters S-38..... **$47.50**
S-40 (Replaces S-20R)..... **89.50**
SX-42 (Replaces SX-28A)..... **275.00**

SELENIUM RECTIFIERS

Direct permanent replacement for 117Z6—117Z3 etc. No filament—no socket—no trouble.

1 to 5 net **1.08** 6 to 49 net **98c** 50 or more net **90c**

SLIDE RULE DIALS

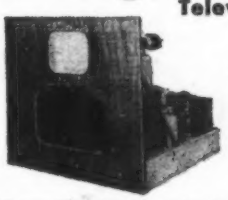
Crowe No. 534—direct ratio drive—antique bronze escutcheon 2¾" x 4"—pointer travel 3¾".
NET with pilot lamp bracket... **$1.74**

V. M. AUTOMATIC CHANGER

A Two Post Changer with well-made mechanism—plays 10" or 12" records intermixed. Low pressure crystal pickup. Size 14" x 14". Packed two to a factory-sealed carton, factory guaranteed.

SPECIAL EACH 15.95 CARTON OF TWO **29.95**

TRANSVISION Television Kit



Proven Circuit
7" Picture Tube
Pre-tuned RF
Special Antenna
100% Complete

Famous Television Kit as advertised by *Transvision, Inc.* complete with all tubes, panel, everything—now available from our stock. Another Radio Supply "First"..... **$159.50**
When ordering, specify station channels needed.

JEWELLED PILOT LIGHT ASSEMBLIES

- Candelabra screw base for 110 volt lamp.
- Mount in 1" hole.
- Lamps removable from front of panel.
- Available marked 1-2-3 or 4 on back of lens.

YOUR CHOICE net **19c**

Include full remittance with orders of $3.00 or less. Include 25% deposit with all C.O.D. orders of $3.00 or more. Prices subject to change without notice.

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RADIO SUPPLY & ENGINEERING CO., Inc.

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Transatlantic News

From our European Correspondent, Major Ralph Hallows

MUSA stands for "multiple-unit steerable antenna. The system was installed at a site in Kent by the British General Post Office to ensure at all times and all seasons distortion-free and fading-free reception of telephonic transmissions from the United States. The quality of these, as relayed to all parts of Britain by the BBC, is now excellent.

The principle of Musa is theoretically quite simple. With a high-frequency transmission, the vertical angle of arrival of the wave trains at the receiving antenna varies constantly owing to rapid changes in the under surface of the F-layer. At any instant there is a particular vertical angle at which incoming signals are at their strongest. But wave trains may be (and probably are) arriving simultaneously at other angles. Fading occurs when there is a phase difference between wave trains arriving at different angles after traversing paths of different lengths. A fruitful source of distortion is the more or less rapid change of polarization of a transmission which may occur during reflection by the F-layer. By making use of superdiversity reception, Musa responds at every instant *(A)* to the signal, whatever its arrival angle, which has the greatest amplitude, and *(B)* to the signal that has undergone the smallest change in polarization.

This is accomplished by what amounts to making the narrow major lobe of the receiving antenna's vertical polar diagram sweep rapidly and continually through a wide arc. The receiver accepts only the best signal at any instant, rejecting all others.

Our Musa station works with the transmitter at Lawrenceville, N. J. Frequencies of the order of 19.82, 14.59, 9.87, 7.55, and 5.08 mc are used, the particular one in operation at the moment depending on the optimum for the state of the sunspot cycle, season of year, and time of day.

The Musa receiving equipment consists of 16 rhombic antennas, spaced at regular intervals over a distance of two miles on the great-circle path to Lawrenceville. These antennas are connected to the receiving apparatus by 16 co-axial transmission lines, the lengths of which depend on the distance between individual antenna systems and the receiving set. The 16 signals are combined after introduction of appropriate phase shifts. These phase shifts cause the major lobe of the vertical polar diagram of the whole antenna system to swing up and down, constantly changing the angle of elevation.

The system is equipped with calibrated cathode-ray tube display units to measure accurately both the optimum wave-angle and the field strength. Records of these have been made at quarter-hourly and hourly intervals ever since the station opened in July, 1942, and are available to both radio engineers and ionospheric physicists.

Russian radio and television

At the moment the USSR claims that big advances in both radio and television have been achieved by Russian scientists. Large-scale plans to extend broadcast services of both kinds are also under way. Twenty-five television stations, it is announced, shortly will be in operation, 21 in European Russia and the rest in Siberia. It is known that work on color television has been going forward for some time, and the latest report is that a color transmitter working in Moscow has a service area with a 75-mile radius. Much attention is being paid to both land-line and radio links between main television and v.h.f sound transmitters and relays sited at considerable distances away. FM has been adopted to a large extent, particularly for the coverage of big cities, where man-made static due to electrical machinery presents almost insuperable problems with AM. How much of all this is fact and how much wishful thinking it is impossible to say. One must however, bear in mind that Russia is the home of many first-rate radio physicists and radio engineers and that almost unlimited funds are available for research and development on approved lines.

FM in Britain

As I have already reported, our BBC has been making experimental FM transmissions on 45 and 90 mc for some time. The conclusions reached as a result of extensive trials are (1) that FM is superior to AM for v.h.f. relays in the quality obtainable and in freedom from interference; (2) that it has also advantages over any form of pulse modulation; (3) that horizontal polarization is very much better than vertical for suppressing the effects of interference. The BBC has now decided to start regular FM broadcasts from a full sized transmitter as soon as it can obtain delivery of the apparatus. A 25-kw transmitter has been ordered from the Marconi Wireless Company. Where it will be erected is still a secret. My guess is that the selected site will be on high ground in one of our midland districts.

Meteors and radio

I was much interested to see a reference to this subject in the February number of RADIO-CRAFT because some very important and interesting work has been done on it. One of the most puzzling problems in radio is the continued existence after dark of the ionized E-layer. If the recombination rate of its atoms is calculated, this should be complete and the reflecting properties of the layer brought to an end very soon after sundown unless something happened to prevent deionization. During the showers of meteors last October from the Giacobini-Zinner stream it was established that each left a trail of ionized air from which radar echoes could be obtained. Recent work by four separate teams of physicists, working under the direction of Sir Edward Appleton and using a variety of methods,

(Continued on page 73)

Suggested by Grego Banshuck, New York City

"There must be a fire in the television studio."

RADIOMEN'S HEADQUARTERS — WORLD WIDE MAIL ORDER SERVICE!!!

SERVICEMEN
Check This Column for Lowest Prices on Quality Parts

TUBES: A warehouse full, including the new miniatures. Order all types you need. We'll try to supply you completely. **Special this month:** Sylvania 6V6gt—3 for $2.00; RK-75 or 307 Transmitting tubes only $2.50 each; 6L6G—99c; 6SD7 (replaces 6SK7)—59c.

POWER TRANSFORMERS—Half-shell type, 110V, 60 cy, Centertapped HV winding. Specify either 2.5 or 6.3V filament when ordering.
For 4-5 tube sets—650V, 40MA, 5V & 2.5 or 6.3V.....$1.49
For 5-6 tube sets—650V, 45MA, 5V & 2.5 or 6.3V..... 1.75
For 6-7 tube sets—675V, 50MA, 5V & 2.5 or 6.3V..... 1.90
For 7-8 tube sets—700V, 70MA, 5V & 6.3 or two 2.5.... 2.35
For 9-11 tube sets 700V, 100MA, 5V & 6.3 or two 2.5V.. 2.85
For 9-15 tube sets—600V, 150MA, 5V & 6.3V..... 2.95

TRANSFORMERS—All types in stock. **AUTO-TRANSFORMERS:** Steps up 110v to 220v, or steps down 220v to 110v—$1.95.
FIL. TRANS.: 6.3v, 8 Amps.—$1.98; 5v, 10 Amps.—$1.98; Universal Output Trans. 8 Watt—89c; 18 Watt—$1.29; 30 Watt $1.69. **AUDIO TRANSFORMERS:** S. Plate to S. Grid. 3:1—79c; S. Plate to P.P. Grids—79c; Heavy Duty Class AB or B. P.P. inputs—$1.49; Midget Output for AC-DC sets—69c; **MIKE TRANSFORMER** for T-17 Shure microphone, similar to UTC ouncer type—$2.00.

CONDENSERS—PAPER TUBULAR 600 WV—.001, .002, .005—8c; .01, .05—9c; .1—10c; .25—23c; .5—36c; **ELECTROLYTICS:** 8mfd 200v—20c; 10mfd 35v—20c; 30mfd 150v—23c; 20/20mfd 150v—35c; 30/20 150v—46c; 50mfd 150v—43c; 8mfd 475v—34c; 16mfd 350v—55c; **OIL CONDENSERS:** 4mfd 600v 49c; **BATH TUB TYPE CONDENSERS:** 3X.1mfd—20c; **RESISTORS:** All types in stock at the lowest prices; Resistor Kits: 100 2 watt resistors—$1.95.

FILTER CHOKES: 200, 300, 400, 500 ohm light duty—59c; 200 or 300 ohm heavy duty—99c; 250 ma 35 ohm, made for U.S. Navy, fully shielded—$1.95; 75 ohm 125 ma—25c or 25 for $4.25; "Meissner type" tapped filter chokes—25c; 8 amp. iron core A filter—25c; Choke-condenser combination, ideal to replace any size speaker field when installing PM speakers—79c. **110 V. CIRCUIT BREAKERS** of Magnetic type: **Following** Current Ratings in Stock; 1.25, 3, 4, 8 Amps. Please specify. $1.95.

SEVEN ASSORTED I.F. TRANSFORMERS—$1.99; Five Ass't. Oscillator Coils—69c.

PERMEABILITY TUNERS—Attractive slide-rule dial, compactly replaces dial, tuning condensers, oscillator and antenna coils in broadcast band receivers. Special $3.43.

WILLARD rechargeable 2 volt storage batteries for G.E. portable radios $2.95.

SPEAKERS-PM dynamic type-4"—$1.55; 5" $1.55; 6"—$1.95; 8"—$3.95; 10"—$5.95; 12"—$7.50.

CRYSTAL PICK-UPS—Two nationally known makes, one **$1.90,** the other at **$2.29.**

PHONO-MOTORS—110V, 60 Cycle, with turntable—$4.25.

HEADPHONES—Highest quality Signal Corps headsets with sponge rubber ear cushions. 12" cord and plug $1.00. 5' rubber covered patchcords with phone plug and socket—25c.

RELAYS—Guardian SPST 12-24v, has heavy duty 15 Amp. Contacts—$1.25; Guardian 19 to 24v D.C. triple make, single break relay, 5 for $3.75; Sigma supersensitive 2000 ohm D.C. SPDT Relay. (May be adjusted to operate on less than 1 Milliampere)—$2.50.

6 POLE, DOUBLE THROW, Telephone Type 2000 ohm Relays. Super Sensitive, $2.50 each, or two for $4.50.

SELENIUM RECTIFIERS—Dry disc type 1½" by 1", 1.2 Amp. maximum, suitable for converting DC relays to AC, for supplying filament source in portable radios, converting DC motors to AC applications, and also may be used in low current chargers—90c.

METER RECTIFIERS—Full wave, may be used for replacement, or in construction of all types of test equipment—$1.25. Half Wave—80c.

FILTER CHOKES—200, 300, 400, 500 ohm light duty—59c; 200 ohm hvy. duty—99c; 250 MA, 35 ohms DC res. Made for U. S. Navy. Fully shielded—$1.95.

LINE FILTERS—110V—each unit contains two 2 mfd. oil filled condensers and a 15 amp. iron core choke. This filter has innumerable uses such as oil burner line filter, etc. A ten dollar value for $8c.

PHONO AMPLIFIERS—A real AC, 110V, 60 Cycle, 6 Watt Amplifier suitable for PA systems and phonographs; with a husky power transformer. Complete with tubes—$12.95.

PUBLIC ADDRESS AMPLIFIERS—25 Watts peak output, 5 tubes, separate controls for Microphone and Phono Inputs. $65.00 value for only $32.00.

WIRE—No. 18 POSJ 2 conductor parallel zipcord, brown. 250' spools—$5.25, 500' spools—$9.95, No. 18 PO brown rayon covered parallel lampcord, 500' spools—$12.25. No. 18 SV round rubber covered double wire for wash machines, vacuum cleaners, etc. 250' spools—$6.95. Rubber covered mike cable. 250' spools—$15.00. All kinds—hook-up wire 1c per ft., transmission line, 50 ohm impedance RG8U, cut to any length, 8c per ft. Single stranded conductor shielded lead with brown rubber over shield, super special, $1.20 per 100 ft., $10.00 per 1000 ft.

MICROPHONES—All nationally known brands. Bullet crystal—$5.45; Bullet Dynamic—$7.45; Mike Jr.—60c; Handy Mike—90c; Lapel Mike—99c; SHURE T-17 MIKES, with push to talk switch—$9c.

20 ASST'D COIL FORMS, including 11 ceramic, 9 polystyrene, and 6 fiber, all useful sizes—50c.

VARIABLE CONDENSERS: 350 MMFD, 5 gang—$1.95; 4 gang—$1.49; 3 gang—83c; 2 gang—79c; 7.5 to 20 MMFD, 1750v spacing, extra long shaft Hammarlund—69c; miniature variables, 25 MMFD—39c; 50 MMFD—40c; 75 MMFD—59c; 100 MMFD—69c; 140 MMFD—79c.

TRANSMITTING RF CHOKES, 4 PIE, 350 Ma.—25c or 4 for $1.00.

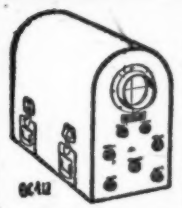
INTERRUPTION FREQUENCY COILS for super-regenerative receivers or the tremendously popular FM adapters for standard broadcast sets. Iron core with a resonant frequency of 50 KC—39c; Air Core, 100 KC—29c.

30 MC IF TRANSFORMERS, double slug tuned—25c.

VIDEO AMPLIFIER PLATE COILS—Slug tuned—25c.

REMOTE CONTROL UNITS: Aluminum case 4x3x2" containing 2 potentiometers, triple pole switch, 4 knobs, gear mechanism, counter and phone jacks—59c.

MODULATION TRANSFORMERS: 10 watt, metal case—98c; 30 watt, open type—$1.95; 40 watt, cast aluminum case—$2.95.



5" Receiver Indicator Oscilloscope with 31 Tubes

This unit, sold by Western Electric for $2500.00, includes a 13 tube receiver with 7 IF stages; 2 tube multivibrator sweep generator; 2 tube sweep amplifier; video amplifier; pedestal impulse and sweep generator; and 115 V, 60 cycle supply with 2X2 for high voltage. Makes a wonderful laboratory instrument, or can be more easily converted to a complete home television receiver than any other war surplus item. ..... Only $69.95

13 Tube BC412 Radar Oscilloscope—Easily converted to a superb laboratory oscilloscope by just a little work. Already 110V, 60 cycle $59.95

RADAR OSCILLOSCOPE APN4. Complete with 27 tubes including 5" cathode ray tube. 18"x9"x12". Shipping Weight 50 lbs. .. $39.95

BC-947 3000 MC ULTRA HIGH FREQUENCY TRANSMITTER

This unit contains amplifier tubes and rectifier tubes, 115 V, 60 cycle power supply, 6 meters including 250 MA, 50 MA, 1 Amp thermo, for input modulating current, 150 V AC, and 1500 V for plate & screen at 1000 ohms per volt. Interior temperature controlled by heater resistances and blower. Plate supply automatically cut off if blower fails. Western Electric charged $1500 for this unit. Your cost only $69.95

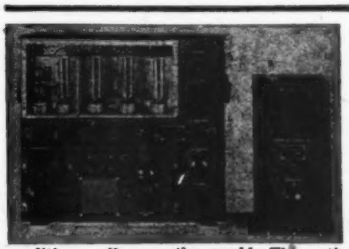
BC 221 FREQUENCY METERS with calibrating Crystal and calibration charts. A precision frequency standard that is useful for innumerable applications for laboratory technician, service man, amateur, and experimenter, at the give away price of only $39.95

5BP4 CATHODE RAY TUBE, 5" tube at the lowest price ever offered $3.95

BC 221

GENERAL ELECTRIC RT-1248 15-TUBE TRANSMITTER-RECEIVER

TERRIFIC POWER—(20 watts) on any two instantly selected, easily pre-adjusted frequencies from 435 to 500 Mc. Transmitter uses 5 tubes including a Western Electric 316 A as final. Receiver uses 10 tubes including 955's, as first detector and oscillator, and 3—7H7's as IF's, with 4 slug-tuned 40 Mc. IF transformers, plus a 7H7, 7E6's and 7F7's. In addition unit contains 8 relays designed to operate any sort of external equipment when actuated by a received signal from a similar set elsewhere. Originally designed for 12 volt operation, power supply is not included, as it is a cinch for any amateur to connect this unit for 110V AC, using any supply capable of 400V DC at 135 MA. The ideal unit for use in mobile or stationary service in the Citizen's Radio Telephone Band where no license is necessary. Instructions and diagrams supplied for running the RT-1248 transmitter on either code or voice, in AM or FM transmission or reception, for use as a mobile public address system, as an 80 to 110 Mc. FM broadcast receiver, as a Facsimile transmitter or receiver, as an amateur television transmitter or receiver, for remote control relay hookups, for Geiger-Mueller counter applications, and it sells for only $29.95 or 2 for $53.90. If desired for marine or mobile use, the dynamotor which will work on either 12 or 24V DC and supply all power for the set, is only $15.00 additional.



GENERAL ELECTRIC 150 WATT TRANSMITTER

Cost the Government $1800.00 Now only $44.50!

This is the famous transmitter used in U.S. Army bombers and ground stations, during the war. Its design and construction have been proved in service, under all kinds of conditions, all over the world. The entire frequency range is covered by means of plug-in tuning units which are included. Each tuning unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications: FREQUENCY RANGE: 200 to 500 KC and 1500 to 12,500 KC. (Will operate on 10 and 20 meter band with slight modification). OSCILLATOR: Self-excited, thermo compensated, and hand calibrated. POWER AMPLIFIER: Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. MODULATOR: Class "B"—uses two 211 tubes. POWER SUPPLY: Supplied complete with dynamotor which furnishes 1000V at 350 MA. Complete instructions are furnished to operate set from 110V AC. SIZE: 21½x23x9¼ inches. Total shipping weight 200 lbs., complete with all tubes, dynamotor power supply, tuning units, antenna tuning unit and the essential plugs. These transmitters are priced to move fast: Order today and be the proud owner of one of the finest rigs obtainable.

BENDIX SCR 522—Very High Frequency Voice Transmitter-Receiver—100 to 156 MC. This job was good enough for the Joint Command to make it standard equipment in everything that flew, even though each set cost the Gov't. $2500.00. Crystal Controlled and Amplitude Modulated—HIGH TRANSMITTER OUTPUT and 3 Microvolt Receiver Sensitivity gave good communication up to 180 miles at high altitudes. Receiver has ten tubes and transmitter has seven tubes, including two 832's. Furnished complete with 17 tubes, remote control unit control unit, dynamotor and Ant. $37.95. We include complete instructions for conversion to 110v A.C.

SCR-274 N COMMAND SETS, including 3 separate 6 tube superhet receivers, 2 separate transmitters, each with 40 watts output, modulator and DC power supply. Bargain price for all 6 pieces complete with tubes $39.95

300 MILLIAMPERE METERS—G.E. or Westinghouse, 3½ inch diameter, flush mounting. Priced at $2.25 each, or 5 for $10.00

AIR CRAFT MARKER BEACON—Complete with 3 tubes and sensitive relay to control external circuits from received signals. Just the receiver you have been waiting for to control models, open doors from a distance, etc. Priced at only.....$ 4.95

AIRPLANE INTERCOM AMPLIFIER—with 4 tubes in aluminum case—

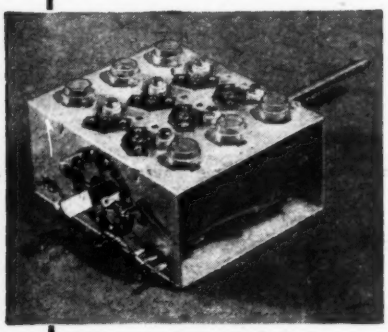
BC-454 TRANSMITTER-RECEIVER—Complete with 17 tubes and 200 Kc. calibrating crystal $39.95

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 4C, BUFFALO 3, N. Y.

Cable Address: BUFRAD

NEW FRENCH RADIO PARTS

By E. AISBERG
Editor *Toute la Radio*



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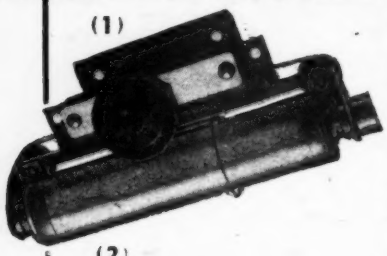

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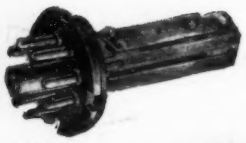

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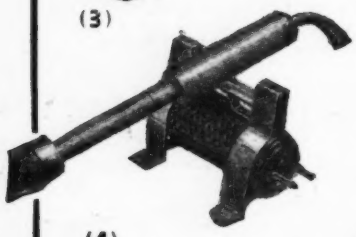


(4)

THE Frenchman is essentially an individualist—that is why France is an artisan's country. The radio industry proves this rule. There are about 50 big radio manufacturers and approximately 200 medium-sized ones. Besides these, one counts literally thousands of small constructors who compete—often successfully—with the big brands.

These small firms occupy themselves largely with assembling receivers from standard components found readymade in commerce. Their artisans do not actually manufacture any of the elements which go into the set. Yet from these readymade parts they design a great variety of receiver models.

From this one understands the great importance of the parts manufacturer to the French radio industry. The postwar shortages, particularly in tubes and all components that require copper, has had a very serious effect on the small constructors. They have had to buy everything they could find—without being too particular about quality. The black market therefore naturally flourishes in the radio field, as it does, alas, in many others, for official allotments give the manufacturers only a small part of the material they need.

What is remarkable under such conditions is that the parts manufacturers have made real efforts to better the quality of their material, even though they know in advance that anything will sell. This is an encouraging sign which proves that the moral stability of the French has not been broken by the trials of the war years.

All this was proved at the recent *Exposition Professionelle des Pièces Detachées* (Professional Radio Parts Show) held at Paris in February, 1947. Not many technical novelties were featured there. The Show was rather characterized by a better quality of material and also that the material was more readily available. We did see, however, a few original items which presage the new tendencies of the day.

In the domain of high-frequency coils, the specialists have presented superheterodyne "blocks" (1) which contain all the tuning and oscillator coils with trimmers, padding condensers, etc., grouped around the switch. These blocks —which are very compact—facilitate construction of the receivers. Most of them have the three usual frequencies: long waves 1,000 to 2,000 meters, medium waves 200 to 600 meters, short waves 10 to 50 meters. Nevertheless, one sees also blocks with higher frequencies. These are generally in the short-wave bands which are again divided into two or three sub-bands. One also finds blocks having a number of spread-bands in the 20, 25, 30, 40, and 50-meter bands.

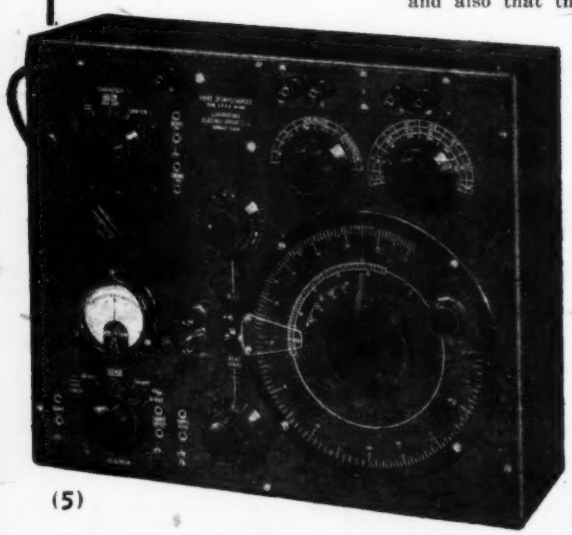
The variable condenser scales are becoming longer and longer. The style usually shows a horizontal dial, more or less slanted backward, placed at the lower part of the receiver.

One constructor exhibited a dial composed of a luminous tube which carries a number of scales (2). Change of ranges is effected by turning the luminous tube around its axis so that the listener always sees the scale of the corresponding frequency band. The pointer is a ring encircling the tube, which is moved along as the set is tuned.

An interesting novelty is presented by an oscillating quartz crystal (3) whose frequency remains rigorously stable in spite of temperature variations. The support of the quartz has a bi-metal (thermostatic metal) armature which flexes more or less, depending on the temperature. The deplacement of this armature with the temperature variation modifies the thickness of the air space of the quartz mounting. Thus variations of frequency which would otherwise have been caused by temperature changes, are compensated by variation of the air space.

An amusing economizer of electric current for a soldering iron (4) was another item which drew attention.

(Continued on page 68)



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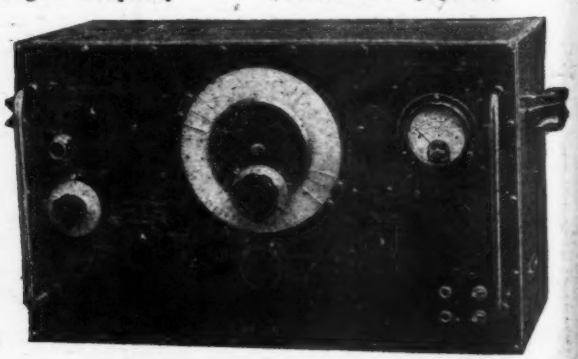

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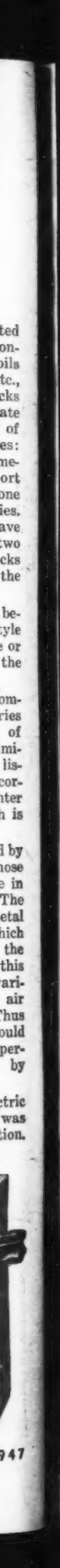
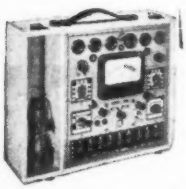


Chicago Parts Show

The 1947 Radio Parts Show at the Hotel Stevens in Chicago chalked up the unprecedented advance registration of 2054. This marks it definitely as predestined to be the most successful parts show held. Of the 2,054 registrants, 885 are member exhibitors, 39 are guest exhibitors, and 489 are members of the National Electronic Distributors Association (NEDA).



The new operating plan of the show, used this year for the first time, confines attendance during the first four days to distributors, exhibitors, and manufacturers who operate through distributors. On Friday, May 16, the show is being thrown open to radio servicemen, amateurs, engineers, and the general public. Exhibitors have been requested to have attendants on hand Friday who can be particularly helpful to these groups.

Program for the show:

SATURDAY AND SUNDAY, May 10 and 11—Organization meetings and sales meetings.

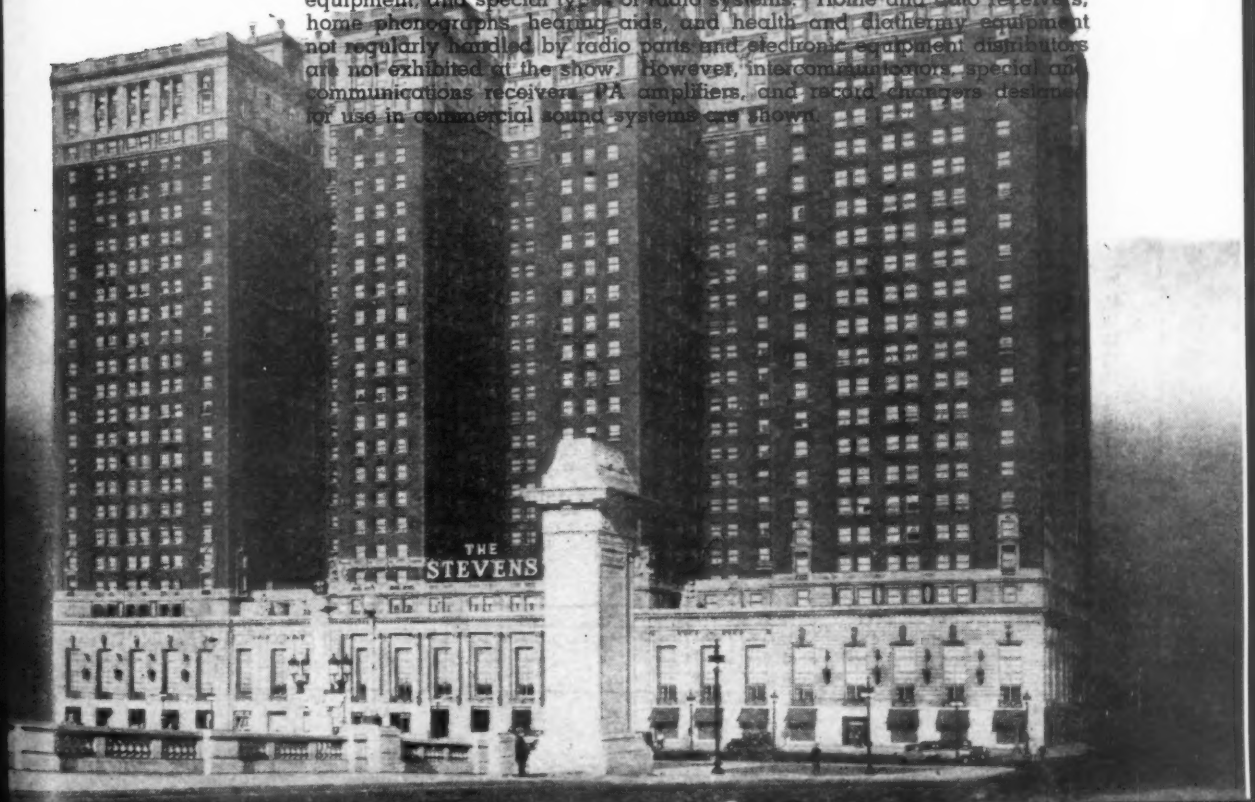
MONDAY, May 12—NEDA Day—No sales meetings to be allowed.
Breakfast sponsored by NEDA for member exhibitors and NEDA members.
12:00 noon—Luncheon meeting of members of sponsoring groups of the show corporation.
7:00 p.m.—Keynote dinner for entire industry, featuring Bill Cunningham, noted sports writer and radio commentator, as guest speaker.

TUESDAY, WEDNESDAY, AND THURSDAY, May 13, 14, and 15—No sales meetings to be allowed on these days. Attendance in Exhibition Hall to be confined to members of sponsoring manufacturers, their booth attendants, and their sales representatives and distributors.
Exhibition Hall open from 10:00 a.m. to 6:00 p.m.

FRIDAY, May 16—Open House Day—Radio servicemen, amateurs, engineers, and the general public will be admitted to the Exhibition Hall without registration. Exhibition Hall open from 10:00 a.m. to 6:00 p.m.

NEDA Day, Monday, May 12, will feature a breakfast for manufacturer guests of National Electronic Distributors Association members and a luncheon for sponsoring organizations (Radio Manufacturers Association, Sales Managers Club Eastern Division, Association of Electronic Parts and Equipment Manufacturers, and National Electronic Distributors Association).

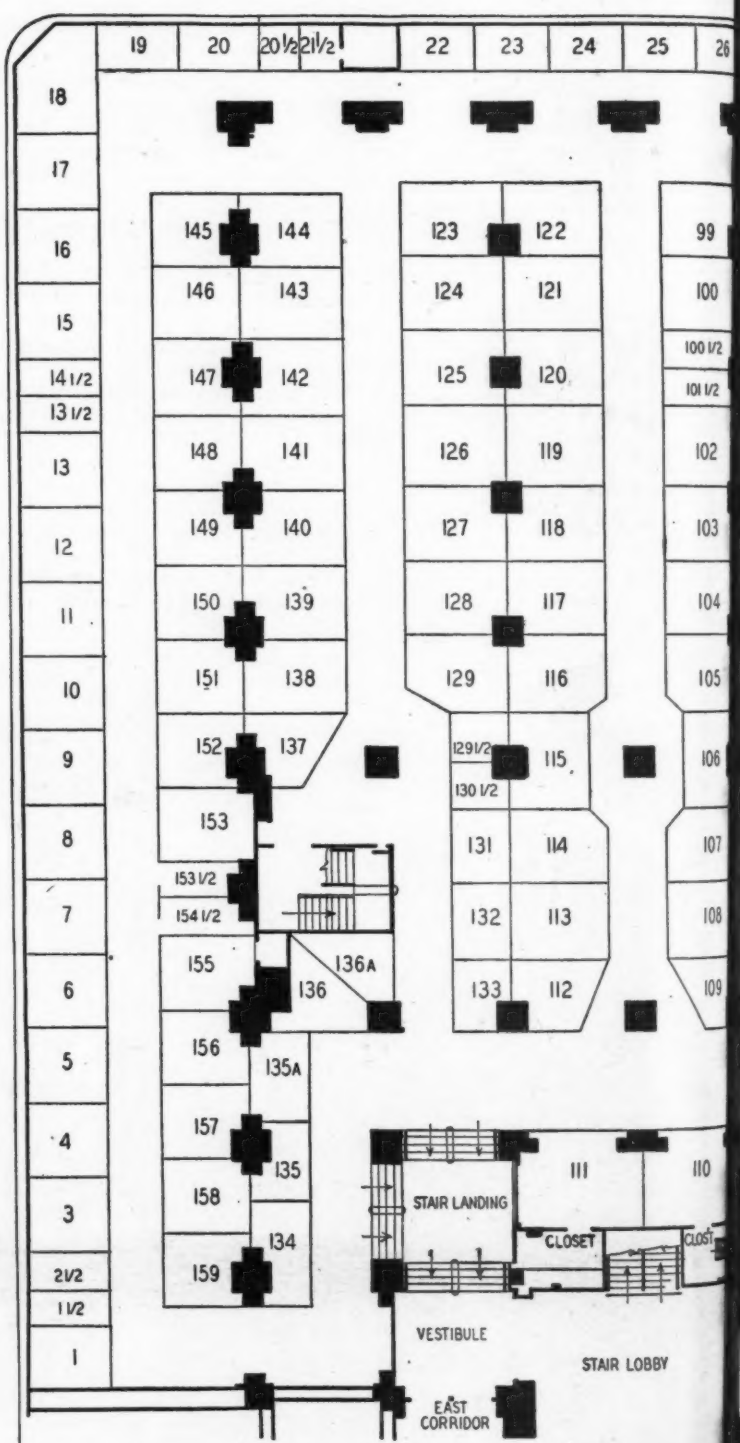
The products displayed cover the whole gamut of radio components, sound equipment, and special types of radio systems. Home and auto receivers, home phonographs, hearing aids, and health and diathermy equipment not regularly handled by radio parts and electronic equipment distributors are not exhibited at the show. However, intercommunicators, special and communications receivers, PA amplifiers, and record changers designed for use in commercial sound systems are shown.



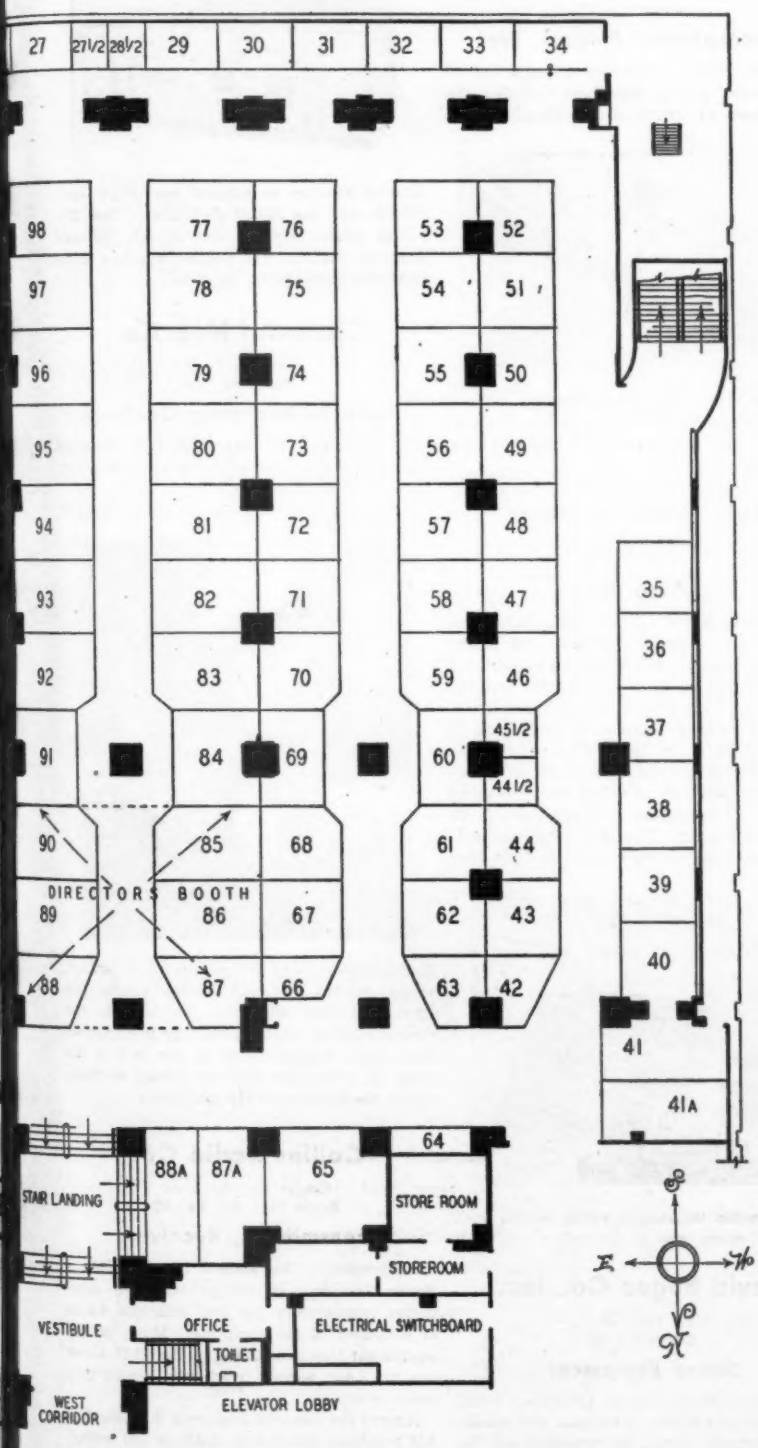
LIST OF EXHIBITORS

Company	Booth
Advance Electric & Relay Company	47
Aerovox Corporation	85
Alliance Manufacturing Company	123
Alpha Metals, Inc.	144
Alpha Wire Corporation	125
American Coil & Engineering Co.	116
American Condenser Company	41A
American Microphone Company	4
American Phenolic Corporation	65
American Radio Hardware Co., Inc.	75
Amperex Electronic Corp.	67
Amperite Company	60
The Astatic Corporation	95
Atlas Sound Corporation	23
Audio Devices, Inc.	148
Barker & Williamson	77
Belden Manufacturing Company	128
Bell Sound Systems, Inc.	66
Bliley Electric Company	78
Boland & Boyce, Inc.	154½
David Bogen Co., Inc.	40
William Brand & Company	13
British Industries Sales Corp.	112
Bruno Tools	76
Brush Development Company	118
Bud Radio, Inc.	39
Burgess Battery Company	34
Burlington Instrument Co.	22
Caldwell-Clements, Inc.	20½
Camburn, Inc.	143
Allen D. Cardwell Mfg. Corp.	134
Carron Manufacturing Company	57
Centralab	68
Chicago Transformer Division	11
Cinaudagraph Speakers, Inc.	3
Clarostat Mfg. Co., Inc.	124
Condenser Products Company	153
Continental Carbon, Inc.	150
Cornish Wire Company, Inc.	48
Cowan Publishing Corp.	130½
Croname, Incorporated	84
Dial Light Co. of America, Inc.	109
Drake Electric Works, Inc.	61
Dumont Electric Corporation	12
Duotone Company, Inc.	20
Eastern Electronics Corp.	111
Eckstein Radio & Television Co.	29
Eitel-McCullough, Inc.	14
Electric Soldering Iron Co.	58
Electronic Engineering Co.	62
Electronic Laboratories, Inc.	56
Electro Products Laboratories	81
Electro-Voice, Inc.	15
Electrovox Company, Inc.	122
The Erwood Company	105
Federal Telephone & Radio Corp.	64
Freed Transformer Corp.	113
General Cement Mfg. Co.	96
General Electric Company	32
General Industries Company	110
General Transformer Corp.	63
Guardian Electric Mfg. Co.	51
The Halldorson Company	37
The Hallicrafters Company	86
Hammarlund Manufacturing Company	90
Hardwick, Hindle, Inc.	36
Herlec Corporation	9
Hickok Electrical Instrument Co.	142
Hytron Radio & Electronics	91
Indiana Steel Products Co.	38
Industrial Condenser Corp.	141
Insuline Corp. of America	114
International Resistance Company	88A
Jackson Electrical Instrument Co.	98
Jackson Industries, Inc.	156
J-B-T Instruments, Inc.	5
Jensen Manufacturing Co.	44
J. F. D. Manufacturing Co.	117
E. F. Johnson Company	73
Kenyon Transformer Corp, Inc.	6
Kings Electronics Company	94
Lectrohm, Incorporated	132
Lenz Electric Manufacturing Co.	104
P. R. Mallory & Company	106

"1947 Radio Parts and
Conference and



Electronic Equipment Show" Floor-Plan



LIST OF EXHIBITORS

Company	Booth
John Meck Industries, Inc.	133
Meissner Manufacturing Co.	93
Merit Coil & Transformer Corp.	52
James Millen Mfg. Co., Inc.	33
Milwaukee Stamping Company	136A
National Company, Inc.	147
National Union Radio Corp.	10
Newcomb Audio Products Co.	7
Ohio Tool Company	135
Ohmite Manufacturing Co.	74
Operadio Manufacturing Co.	139
Oxford Radio Corporation	59
Panoramic Radio Corp.	115
Park Metalware Co., Inc.	136
Par-Metal Products Corp.	24
The Parts Jobber, Inc.	28½
Permo, Incorporated	41
Philmore Manufacturing Co.	119
Potter & Brumfield Mfg. Co.	53
Precision Apparatus Co., Inc.	152
Premax Products Division	18
Price Electric Corporation	145
Pyramid Electric Company	157
Quam-Nichols Company	140
Racon Electric Company, Inc.	158
Rad-El-Co. Manufacturing Co.	87A
Radiart Corporation	79
Radio City Products Co., Inc.	8
Radio Corporation of America	135A
Radio-Craft	21½
The Radio Craftsmen, Inc.	25
Radio & Electronic Jobber News	45½
Radio Essentials, Inc.	99
Radio & Television Weekly	129½
The Rauland Corporation	83
The Recordisc Corporation	27
Recoton Corporation	28
Reiner Electronics Co., Inc.	35
Rek-O-Kut Company	55
Resistors, Incorporated	70
John F. Rider, Publisher, Inc.	120
Howard W. Sams & Co., Inc.	31
Walter L. Schott Company	71
Shur-Antenna-Mount, Inc.	42
Shure Brothers	87
McMurdo Silver Company	138
Simpson Electric Company	149
Mark Simpson Mfg. Co., Inc.	46
SNC Manufacturing Co., Inc.	72
Snyder Manufacturing Corp.	30
Solar Manufacturing Corp.	92
Special Products Company	103
Spirling Products Company	159
Sprague Products Company	89
Standard Transformer Corp.	88
Stromberg-Carlson Company	108
Supreme Instruments Corp.	102
Sylvania Electric Products	50
Talk-A-Phone Company	151
Technical Appliance Corp.	19
Telex, Incorporated	131
Thordarson Electric Co.	126
Trimm, Incorporated	100
Triplett Electrical Instrument	121
Tung-Sol Lamp Works, Inc.	107
The Turner Company	49
United Catalog Publishers	27½
United Transformer Corp.	1
University Loudspeakers	16
Utah Radio Products Div.	97
Vaco Products Company	82
Vertrod Corporation	69
Ward Leonard Electric Co.	127
Ward Products Corporation	80
Waterman Products Company	101
Webster-Chicago Corporation	155
Webster Electric Company	137
Weller Manufacturing Company	43
Westinghouse Electric Corp.	17
Weston Electrical Instrument	54
Wirt Company	146
Workshop Associates, Inc.	129
Ziff-Davis Publishing Co.	44½

Radio Items on Exhibition

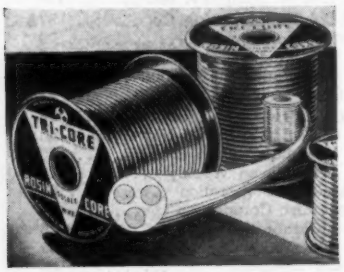
Alpha Metals, Inc.

Brooklyn, N. Y.
Booth No. 144

Tri-Core Solder

Tri-Core, a solder with three independently filled cores of pure rosin flux, is the chief exhibit of Alpha Metals.

A continuous supply of high-grade non-corrosive rosin flux is always present in Tri-Core solder, since the three cores are completely independent of each other. With these three cores, occurrence of "dry" sections in more than one core at a given point is mathematically unlikely, making Tri-Core more efficient and less wasteful than the usual single-core solder.



American Coil & Engineering Co.

Chicago, Illinois
Booth No. 116

Transformers, Reactors, Etc.

American Coil and Engineering Co. is exhibiting a line which includes all types of small and medium transformers, reactors, chokes, and autoformers, as well as r.f. coils and transformers.

American Condenser Co.

Chicago, Illinois
Booth No. 41A

Plastic Capacitors

American Condenser Co. announces its small Amcon plastic capacitor. Measuring only 2⅛ inches high and with a diameter of only 1⅜ inches, this new unit is specifically intended for top chassis mounting, where space is extremely limited. Self-insulating because of its molded plastic case, the unit resists high temperatures and has a wide climatic range.

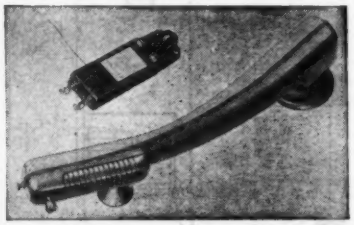
Working voltage of these capacitors is 600, they are tested at 1800 volts. Other Amcon capacitors include tubular and metal-cased (bath-tub) units and 1600-volt vibrator capacitors.

The Astatic Corporation

Conneaut, Ohio
Booth No. 95

Microphones, Pickups, Etc.

Astatic Corp. is featuring a large line of pickups and pickup cartridges, including the new Nylon I-J cartridge and the QT (quiet talk) cartridge. Phonograph pickups include Models 400 and 508. A line of microphones, featuring the 600-, 820-, and 840-S, is on exhibition.

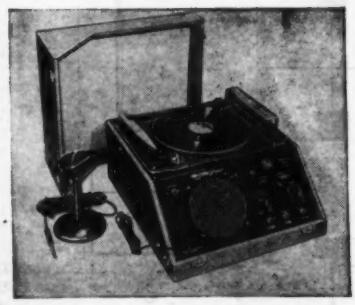


Bell Sound Systems

Columbus, Ohio
Booth No. 66

Recorder

The Bell Model RC-47 RE-CORD-O-fone provides for permanent recording of sound from any source. It records 12 minutes on a 10-inch disc at 33-1/3 r.p.m. (the equivalent to four 12-inch commercial records). It copies a 12-inch commercial record on a 10-inch blank at 78 r.p.m. One central control permits instant selection of all functions: recording, playback and PA use. Plugging in a pair of headphones allows operator to judge every setup. The unit is entirely self-contained in a two-piece, portable case covered with tan leatherette which blends with the rich brown tone of the unit

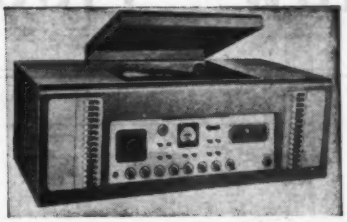


David Bogen Co., Inc.

New York, N. Y.
Booth No. 40

Sound Equipment

The David Bogen Co. is exhibiting a full line of sound systems, intercoms and amplifiers. Featured among the amplifiers are the G050 and G0125 boosters—to be used with existing smaller amplifiers, the PU10 and PU20A and the GX50 and G50. The SM school sound system, the LC-LA DeLuxe intercom, and the SA paging systems comprise other interesting exhibits.



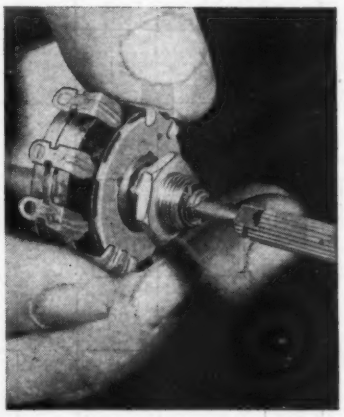
Clarostat Mfg. Co.

Brooklyn, N. Y.
Booth No. 124

Variable Resistors, Controls

Clarostat is exhibiting its line of variable resistors, pads, and controls, featuring the new Ad-A-Shaft system.

The Ad-A-Shaft controls are being stocked in conjunction with an assortment of flatted, round, knurled, and double-flatted shafts. The tip of the shaft slips into the hole in the control bushing until the keyway is engaged, whereupon a sharp blow on the end of the shaft, or hitting the shaft on a hard surface, drives the shaft securely into place.



Collins Radio Co.

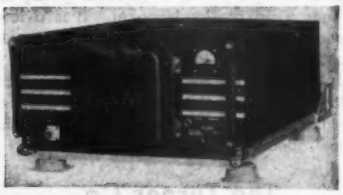
Cedar Rapids, Iowa
Booth Nos. 80, 89, 90

Transmitters, Receivers

Equipment to be shown by the Collins Radio Company is divided into five categories representing the five principal fields of endeavor of the company. Much of the equipment being exhibited in the 1947 show has not been shown previously before any radio group.

Among the featured items are the new 20T AM broadcast transmitter (1,000 or 500 watts), the 3-kw FM broadcast transmitter, the 30K

and 32V ham transmitters, the 75A amateur receiver, and the 188 aircraft transmitter-receiver. Speech input consoles, turntables,



railroad entertainment systems, and amateur equipment occupy important places in the exhibit.

Electronic Laboratories, Inc.

Indianapolis, Ind.
Booth No. 56

Intercommunicators, Etc.

Electronic Laboratories exhibits a line of both war and postwar developments. Among the items featured is a combination radio and intercommunicator. The master unit is a 6-tube radio as well as intercom, and slave stations may be added up to the num-

ber of four. Other Utiliphone intercommunicators will be exhibited.

Federal Telephone & Radio Corporation

Newark, New Jersey
Booth No. 64

Selenium Rectifiers, Etc.

Leading the list of Federal's products is the miniature selenium rectifier, which replaces all conventional receiver rectifier tubes, and represents one of the first real advancements made in home radios since the end of the war. Its improved features are longer life, more immediate rectification,

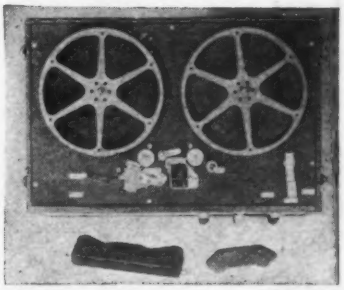
improved efficiency, higher current rating, smaller size, and elimination of the power transformer in some circuits. This minature type selenium rectifier offers manufacturers and servicemen a new source of profit and makes available to the amateur a component that will both improve the performance of his equipment and cut down his costs.

Wire and cable for television and FM, battery chargers, and d.c. power supplies are other exhibits at the Federal booth.

Indiana Steel Products Co.

Chicago, Illinois
Booth No. 38

Magnetic Recorder



Indiana Steel Products is featuring the Hyflux magnetic tape recorder. Hyflux is a finely divided magnetic material with qualities that compare favorably with those of Alnico. Tests now being made with the recorder indicate that besides being a high-fidelity musical recorder, it may be adapted to the following uses: recording audio signals or pulses of any duration or wave length; seismograph investigation; memory record for electronic calculating machines; retention of telegraph signals; multiple single-tone reception (as in electronic organs); control signals for industrial machinery; and continuous advertising or announcing equipment.

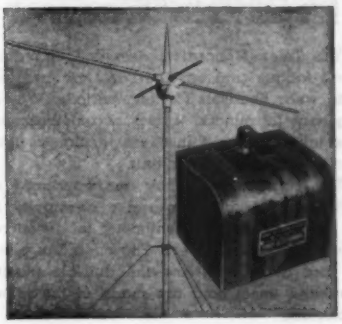
Kings Electronics Co.

Brooklyn, N. Y.
Booth No. 94

Roto-Beam Antenna

Kings Electronics announce its Roto-Beam antenna for television reception.

The antenna covers all the television bands and rotates either clockwise or counterclockwise through 360 degrees, giving optimum reception from stations in any direction. It is operated by a rugged 24-volt motor, which is controlled by a d.p.d.t. spring-loaded switch located in the control box at the set. Neither snow, sleet, nor rain affect the operation and efficiency of the antenna, as it is completely weatherproofed, with a neoprene de-icing skirt completely surrounding the head.



J. F. D. Manufacturing Co.

Brooklyn, N. Y.
Booth No. 117

210-110-Volt Ballasts

The J.F.D. Co. is featuring a new step-down resistor ballast, designed to enable operation of 110-volt radios on 220-volt circuits, common in foreign countries.

These ballasts come with American, British and Continental male plugs; the female sockets are American. They may be used with radios, electric razors, fluorescent fixtures, phono-radio combinations,

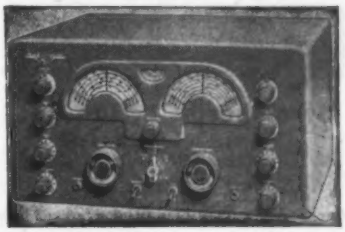
electric clocks, electric blankets and other electrical appliances.

The National Co.

Malden, Mass.
Booth No. 147

Communications Receiver

A new post-war communications receiver for amateur use, the NC-173, is exhibited by the National Company.



The new NC-173 is a 13-tube superheterodyne model with a calibrated band spread covering the 6, 10-11, 20, 40 and 80 meter amateur bands. Its frequency range extends from 540 to 31,000 and from 48,000 to 56,000 kilocycles for both amplitude-modulated phone reception.

Outstanding among the special features of the new National receiver is the automatic volume control, which is operative for both phone and c.w. reception. In addition the S-meter on the NC-173 will also work on both phone and c.w.

Voltage regulated circuits give the NC-173 a minimum of drift and the pitch of code characters does not change appreciably over extended periods of listening time. An additional feature is a new adjustable threshold noise limiter.

Pyramid Electric Co.

Jersey City, N. J.
Booth No. 157

Capacitors

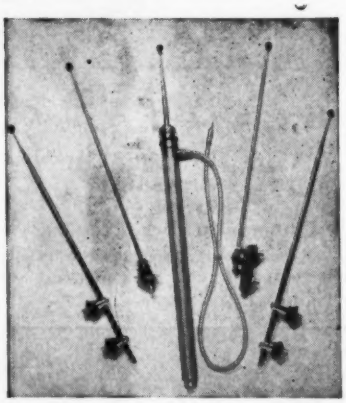
Pyramid's main display is the "Twist-Mount" Capacitor, an ultra-compact, metal-sealed, easy-to-mount dry electrolytic unit. Each of these units is supplied with metal and bakelite mounting plates.

Rad-El-Co Mfg. Co.

Cleveland, Ohio
Booth No. 87AA

Auto Aerials

Rad-El-Co is exhibiting a new concealed type of automobile aerial in two models. The FM-3 is a 3-section aerial extending to 55 inches; the FM-4 a 4-section aerial which extends to 72 inches. The antenna in the center of the photo is the FM-4; it is flanked by other antennas made by the same manufacturer.



Stromberg-Carlson Co.

Rochester, N. Y.
Booth No. 108

Sound Systems, Etc.

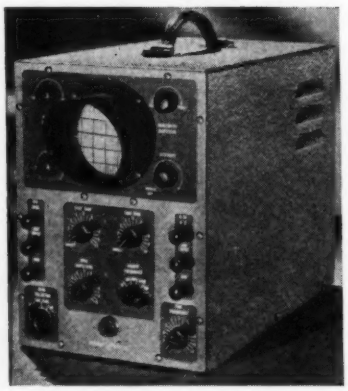
Stromberg-Carlson is displaying at the show its new standard sound systems, three new centralized systems for schools, new amplified intercommunicating systems, new intercommunicating telephone designs, a new line of reproducers and reproducer housings, as well as its complete line of universal amplifiers, record amplifiers, power amplifiers, pre-amplifiers, Alnico V cone speakers, and microphones.

Among the featured items are the Model 750 and Model 1200 sound systems (the latter for schools), the Model 33 amplifier, and the Stromberg-Carlson intercommunicating system.

Sylvania Electric Products

New York, N. Y.
Booth No. 50

Test Equipment



Three new additions to Sylvania's line of test equipment are exhibited for the first time at the Chicago Radio Parts Show.

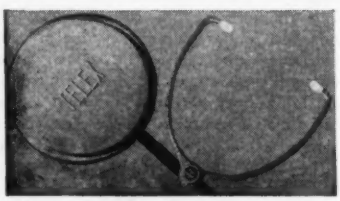
The 7-inch oscilloscope type 132, the audio oscillator type 145, and the signal generator type 150 are shown in handmade models. Announcement of the availability dates on these new pieces of test equipment also is being made at the show.

The new 7-inch oscilloscope is designed for general purpose use by laboratories and radio service dealers. The new audio oscillator and signal generator has unusual stability, wide coverage, and a high degree of accuracy. The signal generator also possesses several novel calibration features.

Telex, Incorporated

Minneapolis, Minn.
Booth No. 131

Headset, Pillow Speaker



The Telex Monoset is designed to reduce head fatigue and ear pressure for operators who wear headsets for long periods. Weighing only 1.2 ounces, it uses two stethoscope-like tubes that end in clear plastic ear tips, and a single magnetic unit.

The standard unit has an impedance of 128 ohms per receiver and a sensitivity of 18 dynes per square centimeter for 10 microwatt input per receiver. The miniature plug-in cord attachment and the durable plastic insulated tinsel cord are made of the finest materials.

The Telex pillow speaker is a flat plastic electromagnetic sound generating unit designed to reproduce sound normally when placed under a pillow or cushion, giving the listener a private loudspeaker. It is a low-impedance unit designed to work from the secondary of the output transformer, and is supplied with a closed-circuit jack, permitting it to be hooked up in the output circuit so that the regular speaker is cut out when the pillow speaker is plugged in.

The Turner Co.

Cedar Rapids, Iowa
Booth No. 49

Noise-Cancelling Microphone

A new hand microphone, designed for use in factories, machine shops, railroad yards, aircraft, and other places where background noise prevents intelligible communication with standard equipment, is being exhibited by The Turner Company. The Model 15D-NC cancels out background noise, permitting only close talking speech to be transmitted. It is a hand-held dynamic microphone, housed in a tough, lightweight alloy case finished in gunmetal enamel. The 15D-NC is available in 50, 300, 500 ohms or high impedance.

Webster-Chicago Corp.

Chicago, Illinois
Booth No. 155

Recorder, Record Changers

Webster's leading exhibits are its Model 80 wire recorder and Model 70 record changer. Model 80 wire recorder is an all-purpose, self-contained portable magnetic wire recorder and player. It consists of a simple, efficient wire-transporting mechanism, recording amplifier, playback amplifier, and 5¼-inch speaker built into a compact carrying case. Furnished complete, ready to play with microphone, power cord, and a supply spool of wire.

The Model 70 is a single-post, cushioned spindle intermex record changer. Simple in operation, it provides automatic or manual playing of both 10- and 12-inch records intermixed or in full stacks of either size, or individually. Home recordings, children's records, or "inside out" records up to the 12-inch size may be played manually.

JOBBERS AND DEALERS DIRECTORY
FOR READERS OF RADIO-CRAFT

This list of Radio Jobbers and Dealers has been compiled as a service to RADIO-CRAFT readers. The magazine is sold by the stores listed below where they are displayed on counters and shelves for your convenience. At these stores you will also be able to buy standard parts, sets and every other product of the radio and electronic industry.

ALABAMA

Decatur
Radio & Tel. Sup. Co.
717 Bank St.

Dothan
Hand Wholesale Radio & Refrig.
707 S. Oates St.

Tuscaloosa
Allen & Jemison Co.

ARIZONA

Phoenix
Radio Specialties & Appl.
401 W. Jackson

ARKANSAS

Fort Smith
Packard Radio Co.
205 Garrison Ave.

Texarkana
Lavender Radio Sup. Co.
Ash at 4th Sts.

CALIFORNIA

Fresno
Jack C. Arbuckle
1427 Broadway

Hollywood
Hollywood Radio Sup., Inc.
5521 Hollywood Blvd.

Yale Radio Electric Co.
6616 Sunset Blvd.

Long Beach
Fred S. Dean Co.
969 American Ave.

Scott Radio Supply
228 Alamitos Ave.

Los Angeles
General News Agency
826 W. 5th St.

Papoi Bros.
2639 E. 4th St.

Radio Tel. Sup. Co.
1509 So. Figuero St.

Electric Supply Co.
149 - 12th St.

Sacramento
E. M. Kemp Co.
115 R. St.

Sacramento Elec. Sup. Co.
711 Capitol Ave.

San Bernardino
George D. Bagley Co.
1216 D St.

San Diego
Harold W. Burt Radio-Electronic
4162-64 Park Blvd.

Electronic Equip. Distr.
1220 2nd Ave.

Western Radio & Elec. Co.
1415 India St.

San Francisco
Associated Radio Dist.
1251 Folsom St.

San Francisco Radio & Supply Co.
1284 Market St.

San Jose
Frank Quemost Wholesale Radio
158 W. San Francisco St.

Santa Ana
Radio & Tel. Equip. Co.
207 Oak St.

Oakland
Electric Supply Co.
149 - 12 St.

COLORADO

Denver
McGee Radio & Elect. Co.
1330 Broadway

Radio Products Sales Co.
1237 16th St.

Western Electronic Lab. Co.
913 15th St.

Grand Junction
Radio & Electronics Supply Co.
418 South 7th St.

Variety Electric Co.
601 Broad St.

CONNECTICUT

Bridgeport
Coastal Radio Service Co.
1559 Stratford Ave.

R. C. Seeil & Co., Inc.
84 Elm St.

L. N. Waidhaus
1132 Norman St.

Hartford
R. G. Seeil & Co.
817 Asylum St.

New Britain
United Radio Supply
53 E. Main St.

New Haven
Congress Radio & Battery Co.
287 Congress Ave.

Rockville
Alfred C. Dennen
38 Park Place

DELAWARE

Wilmington
Radio Electric Service Co.
4th and Tatnall Sts.

DISTRICT OF COLUMBIA

Washington
Capitol Radio Wholesalers
2126 14 St. N. W.

Intercommunications Co.
2027 Nichols Ave. S.E.

Kenyon Radio Supply Co.
2214 14th St. N.W.

Sun Radio
938 N.W. F St.

FLORIDA

Jacksonville
Radio Parts Co.
712 Main St.

Thurow Distr. Inc.
15-17 E. Church St.

Miami
Thurow Distr. Inc.
420 S.W. 8th Ave.

Orlando
Thurow Distr. Inc.
131 South Court St.

St. Petersburg
Welch Radio Supply
408 9th St. So.

Tallahassee
Thurow Distr. Inc.
213 E. Tennessee St.

Tampa
Thurow Distr. Inc.
134 S. Tampa St.

West Palm Beach
Thurow Distr. Inc.
306-310 So. Olive Ave.

GEORGIA

Augusta
Prestwood Electronics Co.
727-29 Reynolds St.

Columbia
Radio Sales & Svce. Co.
1326 First Ave.

Macon
Guy White Radio
654 Mulberry St.

ILLINOIS

Benton
Lampley Radio Co.
802 N. McLeansboro St.

Danville
Allen Electric Co., Radio Supply
109 N. Hazel St.

Decatur
York Radio Distr. Co.
801-805 N. Broadway St.

Chicago
Allied Radio Corp.
833 W. Jackson Blvd.

American Parts, Inc.
910 W. Randolph St.

Concord Radio Corp.
901 W. Jackson Blvd.

Electronic Distributors
620 W. Randolph

Lake Radio Sales Co.
615 W. Randolph St.

Radio Shack
690 W. Randolph St.

Radelek Co.
601 W. Randolph St.

Schuh Radio Parts
1253 Loyola Ave.

East Moline
C. L. Swanson Radio Laboratory
933 15th Ave.

Goreville
Century Supply Co.
Main St.

Rockford
H. & H. Electronic Supply
510 Kishwaukee St.

Mid-West Associates
506 Walnut St.

Springfield
Harold Bruce
303 E. Monroe

Wilson Supply Co.
108 Jefefrson St.

W. Frankford
Radio Hospital
1107 E. Main St.

INDIANA

Anderson
Seybert's Radio Supply
19 E. 12th St.

Evansville
Castrup's Radio Sup.
1014 W. Franklin St.

Montoux Auto & Machine Co.
517 Locust St.

Gary
Cosmopolitan Radio Co.
524 Washington St.

Hammond
Stanton Radio Supply
521 State St.

Indianapolis
Rodefeld Co.
614 N. Capitol

Richmond
Rinehart Inc.
511-513 Main St.

South Bend
Commercial Sound & Radio Co.
534 E. Colfax Ave.

Terre Haute
Terre Haute Radio
501 Ohio St.

IOWA

Council Bluffs
World Radio Labs

Des Moines
G. W. Onthank Co.
11th & Cherry

Dubuque
Boo Distributing Co.
498 N. Grandview

Fort Dodge
Ken-Els Radio Sup. Co.
111 So. 12th St.

Sioux City
Dukes Radio Co.
114 W. 4th St.

Power City Radio Co.
513 7th St.

Sioux City Radio & Appliance Co.
313 Fifth Street

Waterloo
Ray-Mac Radio Supply
324 W. 4th St.

KANSAS

Pittsburgh
Pittsburg Radio Sup. Co.
103 N. Broadway

Topeka
Acme Radio Supply
516 Quincy St.

Wichita
Interstate Distr. Inc.
1236 E. Douglas

Radio Supply Inc.
1125-27 E. Douglas

KENTUCKY

Lexington
Kentucky Radio Supply Co.
519 Georgetown St.

Louisville
Peerless Electronic Equip. Co.
912-914 So. Second St.

Newport
Apex Distributing Co.
506 York St.

Owensboro
Central Electronics Supply
203 W. 4th St.

LOUISIANA

Lafayette
Radio-Electronic Sup.
1419-21 Cameron St.

Monroe
Hale & McNeil
301 Pine St.

New Orleans
Wm. S. Allen Supply Co.
916-918 W. Claiborne Ave.

Radio Parts Inc.
807 Howard Ave.

Shreveport
Kesloway Sales Co.
327 Market

Radio Supplies Inc.
2408 Line Ave.

MAINE

Bangor
Radio Service Lab.
45 Haymarket Sq.

Portland
Maine Electronic Supply Corp.
13 Deer St.

Radio Service Lab.
45 A Free St.

MARYLAND

Baltimore
Henry O. Berman Co., Inc.
12 E. Lombard St.

D. & H. Dist. Co.
31 E. Lee St.

Royal Radio
941 Penna. Ave.

Wholesale Radio Parts Co. Inc.
311 W. Baltimore St.

Cumberland
Cumberland Radio Wholesalers
143 N. Centre St.

MASSACHUSETTS

Boston
Hub Cycle&Radio Co., Inc.
596 Commonwealth Ave.

Sager Electrical Sup. Co.
201 Congress St.

Lawrence
Hatry & Young of Mass. Inc.
639 Essex St.

Melrose
Melrose Sales Co.
467 Franklin St.

New Bedford
C. E. Beckman Co. Commercial St.

Springfield
Springfield Radio Co., Inc.
405 Dwight St.

Springfield Sound Co.
147 Dwight St.

Worcester
Radio Maintenance Supply
19-25 Central St.

MICHIGAN

Ann Arbor
Purchase Radio & Camera Shop
605 Church St.

Berkley
The J. M. Moral Co.
1949 Woodward Ave.

Detroit
M. N. Duffy & Co.
2040 Grand River Ave.

Electronics Inst. Inc.
21 Henry at Woodward

Radio Center
2536 East Davidson

Radio Electronic Supply
1112 Warren West

Radio Specialties
456 Charlotte St.

Radio Supply Co.
6724 Michigan Ave.

Radio Supply & Eng. Co.
129 Selden Ave.

Westside Radio Supply
6724 Michigan Ave.

Flint
Radio Tube Mdse. Co.
508 Clifford

Sheldon Radio & Appliance
2914 N. Saginaw St.

Jackson
Fulton Radio Supply Co.
707 S. Blackstone St.

Lansing
Electric Products Sales Co.
427 E. Michigan Ave.

Muskegon
Industrial Electric Supply
1839 Peck St.

Saginaw
Orom Distributing Co.
801 E. Genesee Ave.

Radio Parts Co.
234 S. Second St.

MINNESOTA

Duluth
Low Bonn Co.
228 E. Superior St.

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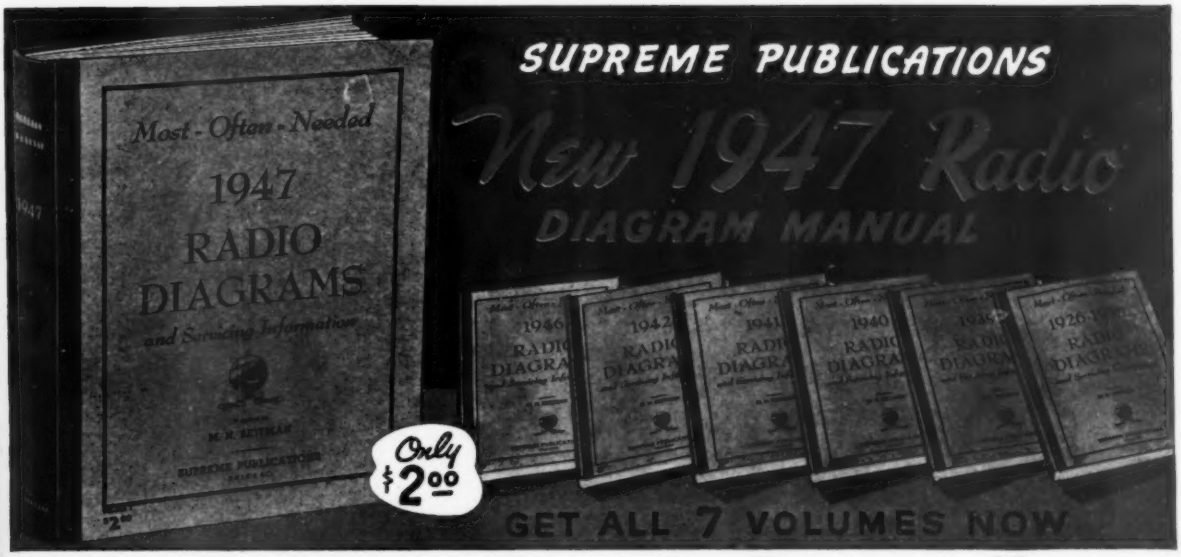

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amplifier plate (as in Fig. 3-b) the cathode needs only 30 to 50 volts. Under these circumstances, the end of the high-voltage unit may be grounded directly, since the 30 to 50 volts bias needed is negligible in comparison to the remainder of the voltage.

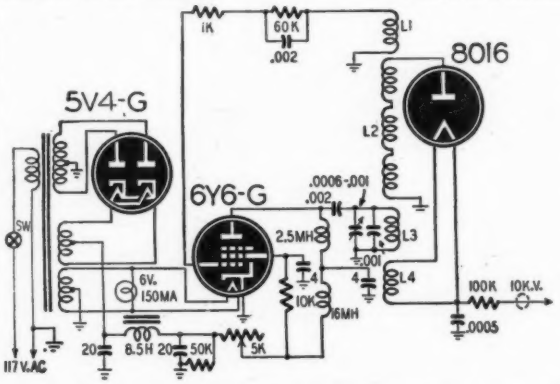

Fig. 4—An r.f. power supply. The filament also operates on r.f.

R. F. power supplies

As we increase the voltages of the high-voltage supply, the cost and the bulkiness of the unit also increases, but at a much greater rate. Projection tubes, which require voltages as high as 27,000, would—if the previous conventional design were followed—lead to a unit far out of proportion to the rest of the set. Two types of power supplies promise at least partial relief from the cost and bulkiness of the conventional supply. Both units develop high-frequency voltages, which are rectified to obtain the d.c. high voltage. The formation of the voltages, however, differs considerably in each system.

The first type of r.f. power supply is shown schematically in Fig. 4. A 5V4-G full-wave rectifier operating from the 60-cycle line supplies the 300 to 350 volts necessary to drive the 6Y6-G oscillator tube. The oscillator itself is a conventional tuned plate, untuned grid tickler coil arrangement. The secondary coil L2 contains more turns than the tuned primary, and steps up the oscillator voltage to approximately 10 kv. Voltage step-up is set at half maximum obtainable to provide high efficiency and good voltage regulation.

The feedback coil L1 is coupled to L2 instead of L3 directly, for greater stability. See Fig. 5. The oscillator tube is biased for Class C operation, resulting in relatively low plate loss and greater efficiency. The 6Y6 (or 6L6) beam power tube can develop 15 watts of power with 80 per cent efficiency at 350 volts, The screen-grid voltage is made self-regulating by a series resistor, and during operation varies from approximately 65 volts at no load to 120 volts at full load.

The high-voltage rectifier is a half-wave unit employing an especially designed 8016 tube. Standard high-voltage rectifiers, such as the 2X2 and 2V3-G, require considerable heater power (3.1 watts for the 2X2 and 12.5 watts for the 2V3-G). The 8016, however, takes only 0.25 watt. This can be supplied directly from the oscillator. At the relatively high frequency of the oscillator, approximately 300 kc, a 500-μμf condenser and a 100,000-ohm resistor provide filtering.

The second high-frequency power supply is based on an idea conceived by P. T. Farnsworth about 1930. Only recently, however, has a good practical model been evolved. The voltage induced in any inductance is governed by the relationship

$$e_L = L\frac{di}{dt}$$

As the time interval dt is made smaller, e_L becomes greater. In the horizontal deflection coils, the retrace interval dt is quite small and a large pulse of voltage is produced. By rectifying the pulse, voltages to 30 kv can be obtained.

A circuit schematic of an "inductive kick" power supply is shown in Fig. 6. The horizontal-sweep amplifier, an 807, is driven by the saw-tooth voltages which are developed in the preceding sweep oscillator. The saw-tooth plate current of the 807, flowing through a portion of the transformer T1, develops a large inductive pulse during the retrace period. Two 8016 rectifier tubes are connected in cascade across the full primary. These tubes rectify the pulses

(Continued on page 69)

Courtesy Essex Electronics

Fig. 5—The high-voltage step-up transformer.

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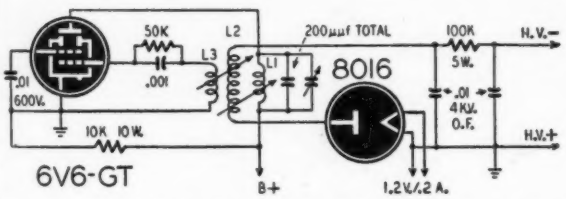
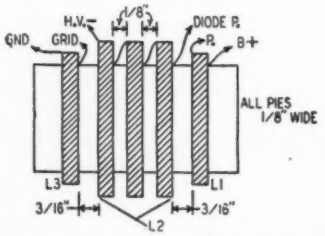


Circuit of the r.f. high voltage supply. Coil system is shown below.



Dimensions of the high-voltage transformer.

The r.f. voltage in the plate coil is transferred to L2 with a step-up ratio of 8.3 to 1. This produces about 2000 volts which is applied to the high-voltage rectifier. This voltage is rectified in a half-wave circuit and filtered in an RC filter consisting of a 100,000-ohm resistor and two 0.01-μf 4,000-volt oil-filled condensers. Although an 8016 rectifier is shown, an 879, 2Y2, or a 2X2 may be used with changes in the filament transformer.

After the coil has been wound, it closely resembles the harmless oscillator coil of a broadcast receiver. This appearance should not be deceiving because the high voltages across L2 are sufficient to cause serious injury or DEATH.

The core of the coils is a polystyrene rod ¾ inch in diameter and about 1½ inches long. The secondary winding consists of a total of 500 turns of No. 9/44 Litz wire wound in three pies to prevent high-voltage breakdown between turns. The feedback and plate windings, each consisting of 60 turns, are pie-wound on opposite ends of L2. All dimensions are given in the figure.

The coils should be shielded with a coil shield that will allow *at least* ½-inch spacing from the nearest conductor. All leads should be kept as short as possible and sharp bends in the high-voltage wiring should be avoided to prevent power losses through corona discharges.

The high-voltage output of the unit may be adjusted roughly by varying the screen-grid voltage of the oscillator tube. Precise adjustments are made with the tuning condensers across L1.

The positive output of this circuit is grounded. If grounded negative is required, 4,000-volt insulation should be used on the filament transformer, or a battery, well insulated from ground, may be employed.

This circuit appeared in the January-February, 1946, issue of *Radiotronics Technical Bulletin*, published in Australia.

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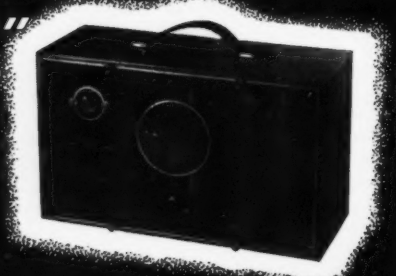

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The construction of a folded dipole may be considerably simplified without sacrifice of efficiency by using a length of 300-ohm line for the antenna itself. Many amateurs are using such an antenna for receiving and transmitting on high-frequency bands, and the same design makes a very effective FM or television receiving antenna. Only about 5 feet of line is necessary for the new FM band which is now being incorporated in many receiver models. Reception is at least as good as with a straight dipole, and it is often much more convenient to match to the 300-ohm line.

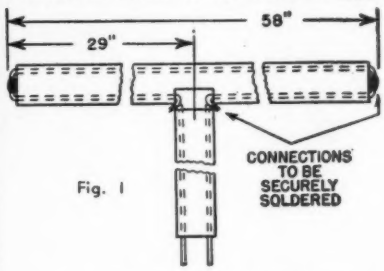

Fig. 1

Fig. 1 shows how the antenna is made. The 300-ohm twin-lead transmission line may be type K-1046 (Federal Telephone and Radio) which is especially suitable because of its flexibility, weather-resistance, and very low loss. A 58-inch length of line is shorted at both ends after stripping the insulation as shown. The ends are twisted and soldered. Then one of the conductors

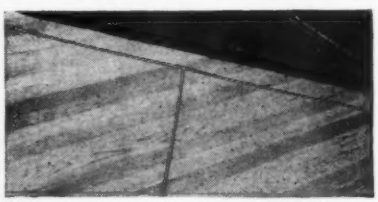

Photo courtesy Federal Telephone and Radio Corp.

Dipole is installed on the floor under a rug.

is cut at its center and the insulation stripped to expose the two ends which are soldered to the transmission line. The distance between the two ends is equal to the distance between conductors of the twin lead. All connections should be lacquered after soldering.

The folded dipole should be erected as high as possible and away from obstructions. It is mounted to any suitable insulator such as wood and is supported at the two shorted ends. In some cases sufficient signal strength may be available to use an indoor antenna. The folded dipole then can be placed under a rug or behind furniture, as shown in the photo.

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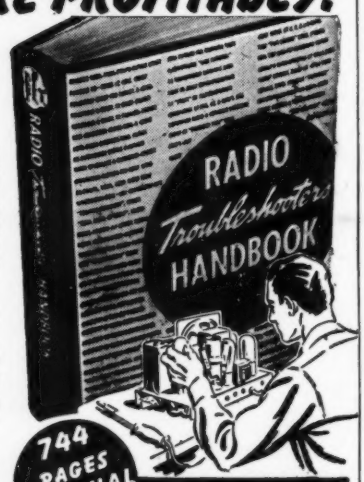

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On this set, the tuning condenser is insulated from the chassis by mounting it on the dial. The dial sometimes permits the condenser to sag and make contact with the chassis at the rear, causing the set to stop playing. This may be cured by cementing a piece of sponge rubber to the chassis just under the rear of the tuning condenser.

HAROLD L. BLISS,
Francesville, Ind.

. . . . AIRLINE 04BR511A AND 04BR512A

Persistent audio oscillation and feedback that does not respond to ordinary methods can be cured by replacing the 12SQ7 tube. Try several tubes. It will not be necessary to discard the offending tube, as it will usually work well in other sets.

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Cabinets of many table model combinations are constructed so that needles and other trash can slide between the player panel and the cabinet wall and fall into the speaker assembly, lodging between the voice coil and the pole piece. This often causes a loss in volume and distortion. After cleaning the speaker, make a cover of light cloth and place it around the speaker. This protects the speaker from dust and other foreign matter. (A speaker cover of this type is standard equipment on many European sets.)

MCCLESKEY RADIO CO.,
Baton Rouge, La.

. . . . SPEAKER REPAIRS

When replacing speaker cones, it is often difficult to remove dirt and filings from around the pole piece. I find it helpful to take a piece of scotch tape and probe around the pole piece. Foreign matter will adhere to the sticky side of the tape, leaving the air gap nice and clean.

JEROME COOPERMAN,
New York, N. Y.

. . . . EMERSON 1940-1941 MODELS

Many of these models use 25AC5 output tubes which are difficult to replace. I tie the No. 3 and No. 4 pins together at the socket and use a 25A6. No other changes are necessary since the filament voltages and currents are identical.

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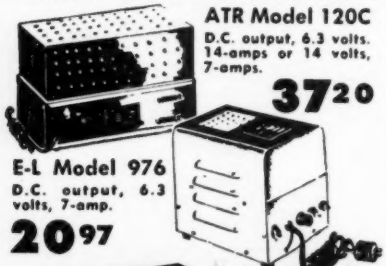

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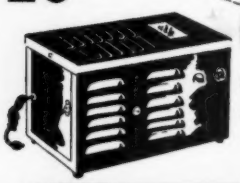

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MULTIVIBRATORS

(Continued from page 25)

is triggered externally. The previously described circuit may be "locked in" by an external source, but will continue to function when the excitation is removed. Fig. 5 illustrates a single-ended or one-kick multivibrator. The name is derived from the fact that such a circuit will complete one cycle of operation with each triggering pulse. When the triggering pulse is removed, the oscillation ceases.

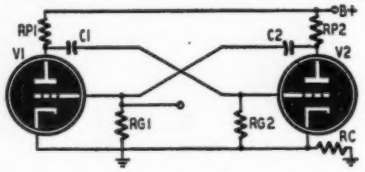

Fig. 5—Circuit of a one-kick multivibrator.

Fig. 5 is similar to Fig. 1, with one exception. In Fig. 5, V1 is normally cut off while in Fig. 1 both tubes are normally at zero grid bias. In the latter circuit, bias for V1 is provided by the voltage drop across RC caused by V2 current. V2 is conducting because the grid is connected directly to the cathode through RG2. Due to this bias, V1 will remain cut off whenever V2 is conducting and oscillation will stop.

The one-kick multivibrator

Fig. 6 is a time-plot analysis of one-kick multivibrator operation. The resting potential on the plate and grid of each tube is indicated on each oscillogram by a dot. A positive pulse is applied to the grid of V1, which is normally below cut-off. The following operation is almost identical to the second half-cycle of the circuit in Fig. 1. V2 grid is driven below cut-off by the multivibrator action and the cathode bias on V1 disappears, since V2 is no longer conducting. The charge on C1 leaks off through RG2, and, at T1, V2 begins to conduct, once again completing the cycle. Current flows through RC and the resulting voltage drop biases V1 grid below cut-off as before. The circuit will remain in this original condition until another positive triggering pulse is applied to V1 grid.

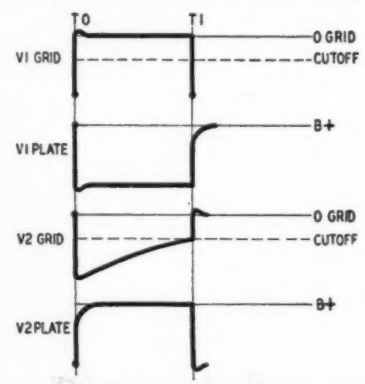

Fig. 6—Analysis of one-kick vibrator action.

From Fig. 5 it is seen that only one slow phase is present in the one-kick-multivibrator operating cycle. This slow phase is determined by the RC grid constants of the tube that is cut off during the cycle.

The one-kick multivibrator provides, among other uses, a method of producing pulses of a definite frequency and time duration. For example, in a certain electronic application it is desired to operate a pair of thyratron mercury-vapor rectifier tubes for 500 microseconds and have them inoperative for 1,000 microseconds. Such regulation is easily accomplished by the one-kick multivibrator. The positive pulse from the plate of V2, as shown in Fig. 5, is applied to the thyratron grids, causing the tubes to conduct for length of time from T0 to T1. This time is limited to

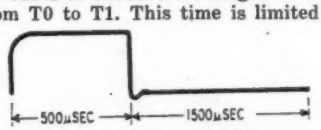

Fig. 7—The multivibrator as pulse generator.

the required 500 microseconds by adjusting RG2 and C1. The necessary wave form is shown in Fig. 7. The total length of the pulse would be 2,000 microseconds, since the negative portion would be 1,500 microseconds. By again referring to formula: f equals $1\lambda t$, we find f must equal 500 pulses per second for our purpose. This will be the frequency of the triggering pulse applied to the multivibrator.

The preceding example illustrates only one of the many possible applications of the multivibrator to electronic circuits. Additional similar applications for industrial and other uses should suggest themselves.

From a more conventional point of view, the multivibrator, as employed in cathode-ray sweep circuits, is of practical interest. This circuit provides one of the better means of producing a high-speed sweep. Such a sweep voltage is required in the television receiver. Fig. 8 illustrates a variation of a multivibrator-type sweep generator that is suitable for extremely high-speed sweep applications. This circuit operates like that of Fig. 5.

Between triggering pulses, while V2 is cut off by the voltage drop across RC, sweep condenser C charges to B-plus

(Continued on page 96)

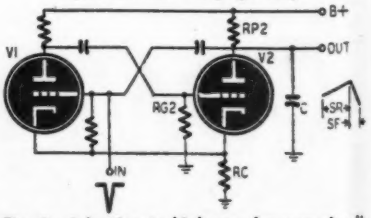

Fig. 8—Adaption to high-speed sweep circuit.

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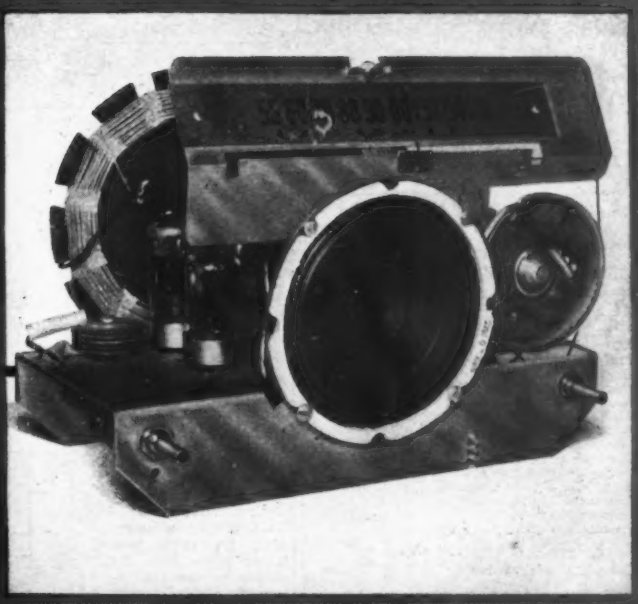

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New Radio-Electronic Patents

By I. QUEEN

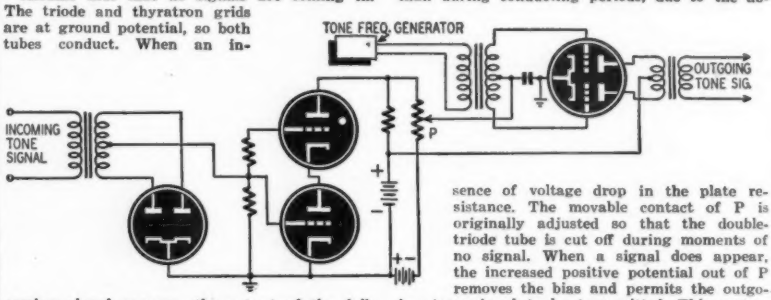
TELEGRAPH REPEATER

William E. Simpson, S. Ozone Park, N. Y.
Patent No. 2,404,754

It is often necessary to receive high-speed telegraph signals on one channel and transmit them on a different channel. This may be done electronically with the circuit shown.

Assume first that no signals are coming in. The triode and thyratron grids are at ground potential, so both tubes conduct. When an incoming signal appears, the output of the full-wave rectifier is applied to the grids as a negative voltage, cutting off both tubes. The triode allows the thyratron to de-ionize rapidly because both tubes are in series.

During the time that the thyratron is cut off, the voltage drop across potentiometer P is higher than during conducting periods, due to the absence of voltage drop in the plate resistance. The movable contact of P is originally adjusted so that the double-triode tube is cut off during moments of no signal. When a signal does appear, the increased positive potential out of P removes the bias and permits the outgoing tone signal to be transmitted. This system allows keying of the local generator rapidly and in accordance with the incoming telegraph signal.



RADIOTELEGRAPH A.G.C.

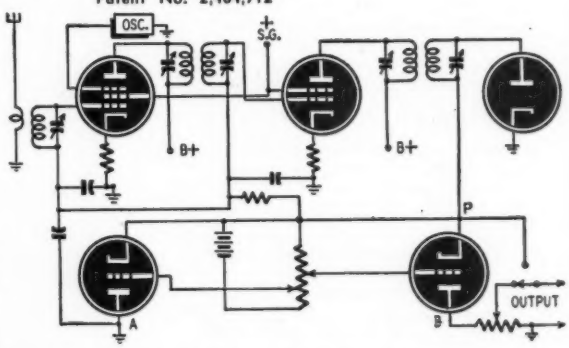
R. Lee Hollingsworth, Riverhead, N. Y.
Patent No. 2,404,712

The requirements for automatic gain control circuits are different for code reception than for "phone." In the former case a sudden burst of static or increased signal strength may block the receiver and cause the loss of the first few characters of a high-speed code transmission. Also, the charge on the condensers of an a.g.c. system leaks off during spaces between signals so that the gain of the receiver varies.

The difficulties are eliminated in the circuit shown. The signal is heterodyned, amplified and rectified in a conventional three-stage circuit. Note, however, that the amplifier grids are isolated unless either tube A or B conducts. These tubes have special functions.

The detector output flows through B and develops an a.g.c. voltage at point P. B conducts only when a signal is received, and may be adjusted for delayed a.g.c. Tube A is adjusted to be cut off without signal input. It conducts only when a *powerful* signal or surge of static appears. During these intervals the tube bypasses current and prevents the receiver from blocking.

Due to amplifier grid isolation, this receiver maintains its sensitivity without regard to the length of spaces between signals.



TIME-INTERVAL MEASUREMENT

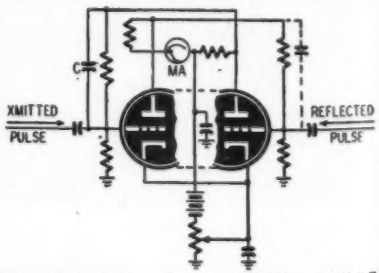
William S. Wilson
(Assigned to Radio Corp. of America)
Patent No. 2,412,111

This circuit greatly simplifies the equipment needed to measure short time intervals between pulses. It may be required, for example, to measure the interval between a transmitted pulse from an aircraft and that of the echo received from ground (as used in altimeters to determine the height of the airplane above ground).

Two triodes are used in a multivibrator circuit. They may be in separate envelopes or a single unit such as a 6J6. Transmitted pulses are applied to the first grid as negative potentials through a coupling condenser. Such a pulse cuts off plate current and causes the voltage to rise sharply. The abrupt change produces a positive voltage on the second grid and therefore increases the plate current of the second tube and causes a sudden decrease of plate voltage. This negative pulse is fed back to the first grid through a voltage-dividing network, charging the condenser C and thus maintaining the tube at cut-off.

The echo pulse is applied to the second grid. It causes plate cut-off and produces a positive pulse which also affects the first grid. The first tube then returns to its normal conducting state and is ready to receive the next pulse.

A d.c. voltmeter measures the plate voltage of the first tube. It assumes an average indication and therefore measures the time during which the first tube is cut off. The shorter the time between transmitted and reflected pulses, the shorter the interval during which there is a high plate voltage, and therefore the lower the average voltage reading. Note that no condenser is used in the plate circuit of the first tube. The second grid is affected by the weak reflected pulse and not by a charge left on a condenser.



Long-distance Television is twenty years old

At the 1927 demonstration, Dr. Herbert E. Ives explained the television system developed in Bell Telephone Laboratories.

APRIL 7 is a notable day in communication history, for on that day in 1927 was the first demonstration of television over long distances. Large-scale images were flashed from Washington, D.C., by wire and from Whippany, N.J., by radio to a public demonstration in New York City. "It was," said a newspaper, "as if a photograph had suddenly come to life and begun to smile, talk, nod its head and look this way and that."

That was the first of many public demonstrations, each to mark an advance in the television art. In 1929 came color television, and in 1930 a two-way system between the headquarters buildings of A. T. & T. and Bell Laboratories. When the first coaxial cable was installed in 1937, television signals for 240-line pictures were transmitted between Philadelphia and New York and three years later 441-line signals were transmitted. By May, 1941, successful experiments had been made on an 800-mile circuit.

End of the war brought a heightened tempo of development. Early in 1946 began the regular experimental use of coaxial cable for television between New York and Washington, and a few months later a microwave system for television transmission was demonstrated in California.

Transmission facilities will keep pace as a great art advances to wide public usefulness.

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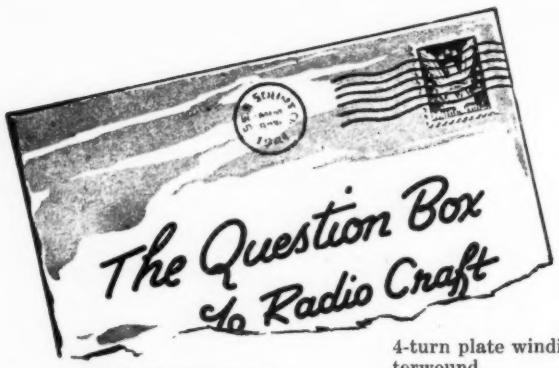
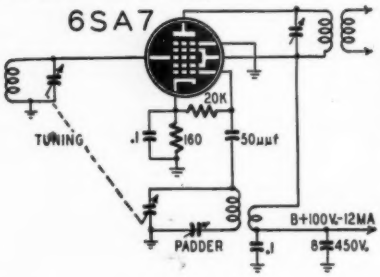


Question Box queries will be answered by mail and those of general interest will be printed in the magazine. A fee of 50c will be charged for simple questions requiring no schematics. Write for estimate on questions that may require diagrams or considerable research.

MIXER CIRCUIT

I would like to replace the 6A7 oscillator-mixer in my receiver with the single-ended 6SA7. Will you kindly draw a circuit showing how this tube may be used without electron-coupled oscillator coils? — O.G.F., Oakland, Calif.

A. The 6SA7 may be used with your present oscillator coil. Connections are shown in the drawing.



COIL DATA

I would like to have coil-winding data for a superhet receiver tuning from 18 to 42 mc. I am using a 6SK7 r.f. stage, and a 6SA7 oscillator-mixer. I have some ¾-inch low-loss forms that I would like to use.—J.W., Tripp, S. Dak.

A. Here is the coil data that you desire. It is designed to cover the range you require when using 450-μμf condensers and a 456-kc i.f. stage.

The secondary of the antenna coil consists of 3½ turns of No. 14 enamel wire spaced to cover about ¾ inch. The primary is 1 turn of No. 28 d.c.c. wire interwound with the secondary. The detector coil secondary is identical with that of the antenna coil. The primary of this coil consists of 2 turns of No. 28 d.c.c. interwound with the ground end of the secondary. The secondary of the oscillator coil consists of 3½ turns of No. 14 enamel spaced to ¾ inch with a 4-turn plate winding of No. 36 s.s.c. interwound.

It is not an easy task to wind and track three stages over this band. It will be necessary to experiment with the spacing of the grid windings to get good tracking throughout the range.

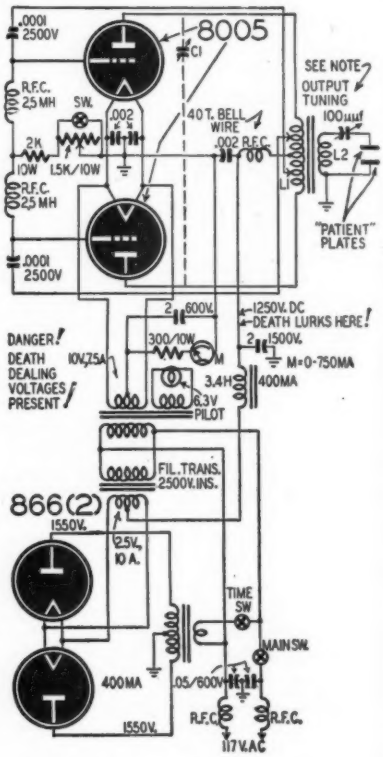
RADIO-THERAPY CIRCUIT

Please print a diagram of a diathermy or radio-therapy machine such as the one described by Dr. Lee de Forest in the August 1943 issue. This should be powerful enough to produce artificial fever and the frequency should be variable between 5 and 18 meters.—J.J.S., Sharon, Pa.

A. A radio-therapy circuit is shown to the right. When properly adjusted, the power will be approximately 300 watts.

As in the case of most circuits of this nature, some experimenting is necessary to obtain the best results. The grid and cathode resistors and the grid excitation taps should be adjusted for optimum performance.

L1 consists of 15 turns wound on a 2½-inch form spaced to 4 inches. L2 is wound with 4 turns spaced to 1¼-inch long. This coil should be well insulated and placed on the inside of L1. Both coils are wound with ⅛-inch copper tubing.



THREE-TUBE RADIO

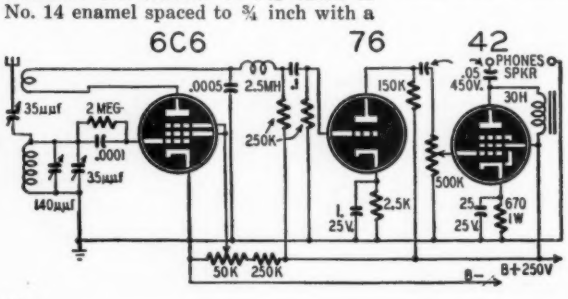
Kindly print a circuit of a three-tube regenerative receiver using a 6C6 detector, 76 first audio, and 42 or 6F6 output stage. I have standard plug-in coils for use with a 140-μμf tuning condenser, a small magnetic speaker, and a 250-volt power supply.—L.J.S., Donora, Penn.

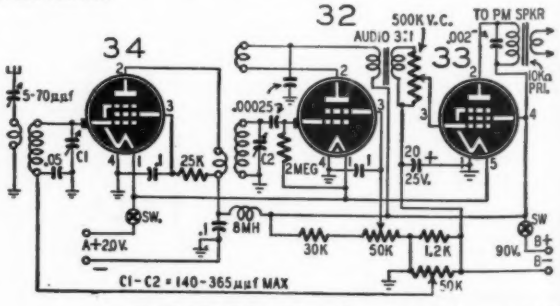
A. Here is a circuit that should meet your specifications. Regeneration is controlled in the 6C6 screen grid circuit. If band spread is desired, a 35-μμf trimmer may be connected across the main tuning condenser as shown.

SET FOR 2-VOLT TUBES

Please print a circuit of a small receiver using a t.r.f. amplifier, a regenerative detector, and a power amplifier stage. I have a 32, a 33 and a 34. —G.A.S., St. Michael, B. W. I.

A. This circuit uses the tubes you specify. Regeneration is controlled in the screen-grid circuit of the detector and the r.f. gain in the grid return on the 34. Standard four-prong coils are used in the r.f. stage and six-prong in the detector circuit.





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Cat. No.	Cap. MFD.	Working Volts	Your Cost
C110	1	3000 Oil	$3.95
C111	3	4000 Oil	$4.95
C112	1	1000 Oil	44c
C114	8	600 Oil	95c
C115	2	600 Oil	49c

Westinghouse 1 MFD 4000 volts WVDC... $7.95
Westinghouse 1 MFD 10,000 volts WVDC..$12.95

CHOKES

Thordarson 8 HY 150M choke, Cat. No. FC-201 ..... 95c

Thordarson 8 HY 175M choke, Cat. No. FC-202 ..... $1.49

Thordarson 12 HY 25M choke, Cat. No. FC-203 ..... 39c

Thordarson 8 HY 350M choke, Cat. No. FC-204 ..... $4.95

FILAMENT TRANSFORMERS

Thordarson 6.3 V-4 amps., 6.3 V-4.5 amps., 9.7 V-.5 amp., pri. 110 V AC 25 or 60 cy.—Cat. No. FT-11 ..... $1.95

Thordarson pri. 110 V 60 cy.—sec. 6.3 V 6 A, CT—Cat. No. FT-12 ..... $1.49

Thordarson 110 V 60 cy. pri., sec. #1-2.5 V, 10 A Ct, 3000 V ins., sec. #2 10 V 3.25 A, Two 5 V 3 A; 6.3 V 1 A—Cat. No. FT-13 ..... $4.95

MICA CAPACITOR

.002 MFD 3000W VDC. Cat. No. RT-101 ..... 49c

IF TRANSFORMER

Mounted in aluminum shield can 1500 KC, with air trimmer, impedance coupled type. Cat. No. T-19 ..... 95c

30MC IF TRANSFORMER

In square aluminum can, silver slug tuned. Cat. No. T-20 ..... 29c

RECEIVER AND TRANSMITTER

SCR-522, 100-156 MC receiver and transmitter. Used, in good condition. Cat. No. RT-10 .... $9.95

HALLICRAFTER RECEIVER

R45/ARR7—contains xtal filter, variable I.F. selectivity A.V.C. and A.N.L. B.F.O. patterned after SX28A Hallicrafter, voltage regulator complete with tubes and power supply components for 110V operation. Catalog No. SX28A. $139.50

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The ideal way of indicating the position of rotary beams, wind indicator, etc. (400 cycle). Line cord and instructions for 110 VAC operation furnished.—Cat. No. SM-100. 2 for $3.95

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receiver. Patterned after S-36A by Hallicrafters. Receives FM and AM signals in the spectrum between 28 and 145 megacycles. Circuit has 14 tubes including voltage regulator for high frequency oscillator. Has two position selectivity control. Contains no internal power supply. Has acorn tubes RF., Osc., and Mixer. Complete with components for power supply including transformer, choke, filter condensers, and rectifier tube. $100.00

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Write for FREE Bulletin

NEW BC 223 AX TRANSMITTER

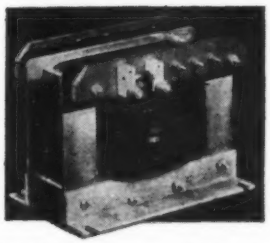
801 Oscillator and 801 Power Amplifiers, 2-46 Modulators and 1-46 Speech Amplifier 4 Xtal Frequencies and Master Oscillator on selector switch. 10 to 20 watts output. Tone Voice or C. W. Mod. Ideal for 80 meter band. Comes with 3 coils TU 17A 2000-3000 Kc. TU 18 3000-4500 Kc. TU 25 3500-5250 Kc. Black wrinkle case. Includes 2 separate cases to store extra coils. Frequencies chart and tubes included, packed in original cases, less crystals at this low price. $29.95

BC 654 TRANSMITTER & RECEIVER

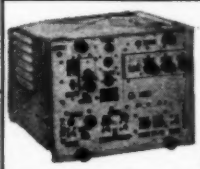
Frequencies range 3800-5800 Kc.—calibration every 10 Kc.—with crystal oscillator checked every 200 Kc.—power output 17 watts, voice or CW. Less tubes $7.95

1 KW MODULATION TRANSFORMER

$14.95 BUY NOW AND SAVE



RCA modulation transformer is conservatively rated at 550 Watt audio to modulate that new KW rig.
Really rugged construction with protective flashover gaps, which are adjustable. Terminals and gaps are mounted on a "Mycalex" terminal board. The laminations that make up this transformer are of high audio quality and are extremely thin, making it impossible for the core to "chatter or talk."
Audio Watts—550 Sec. #1—450 Mills Sec. #2—80 Mills Turns Ratio—Pri: Sec.# 1-1:1 Pri: Sec. #2-5:1 Pri: Sec. #2 Tap—25:1.
Impedance Ratio—Pri: #1-1:1 Sec. Pri: Sec. #2-25:1 Pri: Sec. #2 Tap—625:1.
DC Resistance—Pri: 135 ohms Sec: #1, 112 ohms; Sec. #2, 99 ohms.
Transformers insulation tested: Pri. 8000V.; Sec. #1-11-000V; Sec. #2-2000V. to the rest of the coils and core. Primary center-tapped for Class "B" modulators. Secondary #2 will carry 80 Mils to modulate screens of beam power or screen grid tubes. Primary will match any Class "B" tubes up to 10,000 ohms plate to plate, such as 810's, 75T's, 8003's, ZB120's, 203's, HY51Z's, 211's, 813's, 828's, 805's, 203Z's. Size 9½" wide, 7½" deep, 7¼" high. Heavy channel iron mounting brackets. Weight approx. 40 lbs. Catalog number MT-100.



BN IFF Transmitter & Receiver

Transmitter and receiver. The famous beat anchor, widely used on 144 MC band. Shipping weight 100 lbs. Your price, less tubes and powertransformer. $14.95

TUNING UNIT

Turning Unit BC 375. Approx. 45 M.M.F.D. cond., coils, RF chokes dials, assd mica condensers 2500 WVDC, over $80.00 in parts. Cat. No. TU-101 ..... $3.75

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Type B—frequency range 300 to 1000 megacycles to be used with 368AS door knob tube. Cat. No. BC-2.

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Power supply—inputs 6 or 12 V, output 500 VDC at 160 MA, mounted on box with circuit breakers, relays, interferance filter and two 10 ft. cables. U. S. Govt. surplus. Cat. No. DM-101.

TUBES

813	5.45
RK60	1.25
VT127	2.95
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829	2.45
872	1.95
211	1.45
368AS	4.95

IT4
3S4
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59¢ each

HOT SPOT SPECIALS

Ass't resisters ½ watt fully insulated, in popular ohmages. Cat. No. R-5—per 100 ..... $1.49

Ass't mica condensers, Cat. No. C-12—per 100 ..... $1.95

Wafer sockets, 4-5-6-7 and 8 prong. Cat. No. WF-4—per 100 ..... $2.95

12" Utah P. M. Speaker, Alnico #8 with 6F6 output transformer. Cat. No. ST-100 ..... $6.95

Ass't knobs push on wood and plastic. Cat. No. KP-100—per 100 ..... $1.95

6J4 ..... $1.50 6J6 ..... 95c

Johnson sockets #210-25W. Cat. No. J5-210 ..... 49c

955-9004 tubes. Cat. No. T-99 ..... 65c

Sockets for acorn tubes. Cat. No. AT-10 ..... 19c

8-8 MFD 350 WVDC, 20 MFD 150 WVDC, round can. Cat. No. RC-88 ..... 69c

Hallicrafter volume knobs—SX 28 .. 18c

Pots—screw driver shaft, 2 meg., 1 meg., 150M, 50M, 25M, 5M, 2M, 200 ohm—ea. 29c

A 144 MC Radar Osc., uses 15 E or Hy 75. Enclosed silver plated tank with variable coupling. Complete less tube $3.95

Jacks PL 55, PL 68 ..... 15c

Powdered iron slug with Isolantite coil form to match, ideal for broad tuning E.C.O. 25c

Powderediron ½ slug 10c

1 Meg. Shallcross Accu—Ohm wire wound resistors ±1W 89¢

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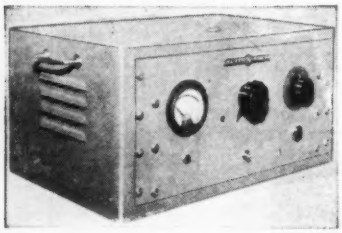
NEW RADIO·ELECTRONIC DEVICES

FLAW DETECTOR

General Electric Co.
Schenectady, N. Y.

The new GE flaw detector can continuously detect and count holes, weak spots, and conducting paths in thin materials, such as paper, sheet rubber, sheet mica, varnished cloth, plastic materials, and enamel films on wire during manufacturing processes. It can be applied to sheet materials up to 0.025 inch thick moving as fast as 450 feet



per minute and to wire moving up to 100 feet per minute.

It consists of an electrode assembly through which an adjustable voltage is applied to the material undergoing test, and an electronic circuit which indicates the flow of current through the material when a flaw passes under the electrode.

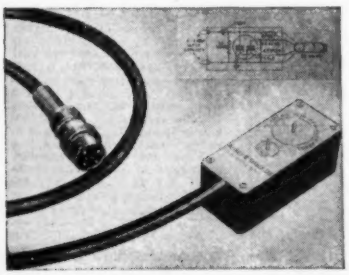
The detector can be made to sound an alarm, operate a recorder, or shut down the manufacturing process when flaws are encountered, and can be arranged to indicate when flaws exceed a given total.—RADIO-CRAFT

HIGH-FREQUENCY PROBE

Alfred W. Barber Laboratories
Flushing, N. Y.

The Model 29 high-frequency probe is designed with an input capacity of ½ to 1 μμf, which extends its useful range to 500 mc.

It is designed to replace the standard



probe used with the Model VM-27 v. t. v. m. It has one-tenth the sensitivity of the standard probe. Consequently, all measured voltages are ten times the indicated values. With the new probe, the Model VM-27 voltmeter has full-scale ranges of 10, 30, 100, 300 and 1000 volts.—RADIO-CRAFT

D.C. RELAYS

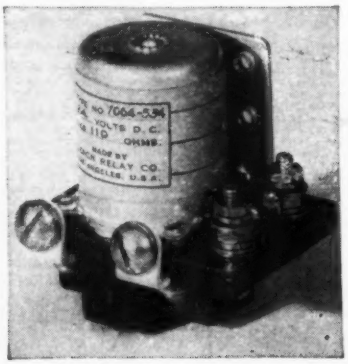
Leach Relay Co.
Los Angeles, Calif.

The new Type 7064-534 relay is a light-weight solenoid d.c. type.

Designed for feeder type planes and small personal aircraft. It is capable of operating at altitudes up to 50,000 feet and at temperatures between minus 54 C and plus 71 degrees C.

Designated Type 7064-534, this relay is supplied with intermittent duty coils for motor starting applications. Type 7064-534-C has duty coils for battery switching, motor control, aircraft and marine radio switching and lighting.

Contacts are made of special silver alloy, are ⅜ inches diameter, and rated at 100 amperes at 12 volts d.c. or 75 amperes at 24 volts d.c. Contact arrangement is s.p.s.t., double break, normally open. Dependent upon the voltage and operating requirements, the coils have a resistance of from 9.5 ohms to 110 ohms. On intermittent duty, coils consume approximately 15.12 watts and 5.23 watts for continuous duty. Each relay weighs approximately 8½ ounces. —RADIO-CRAFT



SIGNAL TRACER

Feiler Engineering Co.
Chicago, Illinois

The TS-2 and TS-3 are battery and a.c.-operated signal tracers, respectively, with jacks for attaching phones, r.f.

or audio output meters. The TS-2 uses two 1T4 and one 3Q4 tubes; the TS-3, two 1T4, one 6K6-GT and one 6X5-GT.

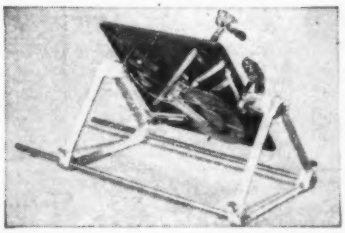
Speaker is a 5-inch PM dynamic (for both models). The probe is 1 inch in diameter, 4⅜ inches long, made of aluminum. It houses the miniature tube, isolating network and associated circuits for the special detector-amplifier. Cable is 3 feet long, heavy rubber-covered.

Size of both models, 8 x 11 x 6 inches. Weight of TS-2 with batteries, 5½ lbs.; of TS-3, 10½ lbs. Case is steel in brown iridescent finish, with beige control panel.—RADIO-CRAFT

CHASSIS RACKS

Aetna Radio Service
Chicago, Ill.

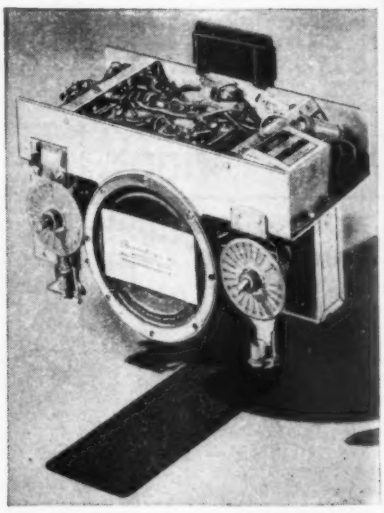
The *Changerak* and *Chasirak* are chassis racks for record changers and small radios respectively.



The Changerak is quickly adjustable to any size record changer, locks positively in any position, and permits normal operation of the unit while in the rack. The changer may be left in the rack till final delivery, which will prevent damage or change in adjustments.

The Chasirak is a small sheet-metal device into which a midget chassis can be clamped quickly. Large radios may be handled by using two Chasiraks.

—RADIO-CRAFT



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SIGNAL GENERATOR

Premier Electronic Laboratories
New York, N. Y.

The Model 570 Signal Generator puts out modulated or unmodulated r.f. on fundamental frequencies from 75 kc to 50 mc, and up to 150 mc on harmonics. The 6J5 oscillator, with air trimmers, feeds into one section of a 6SN7 which is used as a buffer amplifier. The a.f.

oscillator, using the remaining half of the 6SN7, provides 400-cycle modulation with less than 5-percent distortion. Provision is made for applying external audio modulation to the r.f. signal. The power supply operating from a 117-volt a.c. line, uses a 6X5 rectifier.

The dial is direct-reading with a knife-blade pointer driven by a spring-loaded vernier knob. A smaller dial, geared to the main pointer, helps to provide reset calibration accuracy up to 0.5 percent to 1,600 kc and 1 percent on higher frequencies.—RADIO-CRAFT

MARKED RESISTORS

Ohmite Manufacturing Co.
Chicago, Ill.

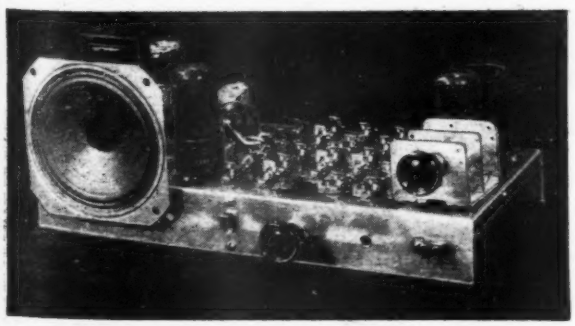
In addition to RMA color coding, these insulated fixed resistors are now individually marked with resistance and wattage for quick, positive identification.

Little Devils are small—size of the ½-watt is only ⅜-inches long by 9-64th-inch diameter—the 1-watt, only 9-16-inch long by 7-32-inch diameter—the 2-watt, 11-16-inch long by 5-16-inch diameter.—RADIO-CRAFT

ELECTRONICS KIT

Deer & Taylor Co.
Berkeley, California

The Magi-Klips experimenter's kit consists of a chassis on which is mounted a 4-inch PM speaker with output transformer, a 50L6 power amplifier tube, a 35Z5 rectifier tube, a plate circuit relay, a 2-gang tuning condenser, a 12SL7 twin-triode tube and a tuning coil socket. A number of extra resistors and condensers are supplied, as well as two plug-in coils.



Leads from the components are run out to 24 Fahnestock clips, making a large number of combinations possible. Among the circuits which can be made up are a regenerative receiver, home broadcaster, code practice oscillator, photoelectric relay, signal tracer, and remote control relay.—RADIO-CRAFT

TUBE TESTER

Triplett Electrical Instrument Co.
Bluffton, Ohio

The Model 2425 tube tester provides transconductance readings through a simple measurement directly proportional to Gm and a properly calibrated measuring instrument. No possibility of grid overloading. Short and open tests of every tube element. Gas tests of all tubes.

Metal case, 10 x 10 x 5¾ inches with tan hammered enamel finish, brown trim. Removable cover.—RADIO-CRAFT

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U.S. GOVERNMENT SURPLUS ELECTRON TUBES

Type	Your Cost	Type	Your Cost	Type	Your Cost	Type	Your Cost
3AP1	$2.95	12DP7	$6.95	5Y3	.43	6SF5	59c
3BP1	2.95	829B	3.50	50L6	.69	6V6GT	69c
5BP1	3.95	6Y6G	.59	6AG7	.69	12SQ7	59c
5CP1	3.95	6AK5	.95	2X2	.79	89	49c
5FP7	3.95	5U4	.59	6SJ7	.49	77	49c
7BP7	4.95	78	.49	12SH7	.49	39-44	49c
9LP7	5.95	12A6	.69	6SS7	.49	2B7	49c
304TH	7.95	6K7	.49	7S7	.49		

RADIO RECEIVERS

BC-454-A; 3-6 mc $6.95
BC-453-A; 190-550 kc $8.95
BC-455-A; 6-9.1 mc $6.95

RADIO TRANSMITTERS

BC-457-A; 4-5.3 mc $7.95
BC-458-A; 5.3-7 mc $7.95

MODULATOR UNIT

BC-456-A $6.95

REMOTE CONTROL BOX

BC-450-A $2.95

ARMY AIRCRAFT RECEIVER
Model BC-946-B

Broadcast band from 520 to 1500 Kc. Tube complement: 3—12SK7, 1—12SR7, 1—12A6, 1—12K8. Designed for dynamotor operation, but is easily converted to 110 or 32 volt operation. Has two I.F. stages and three gang condenser. Comes packed in sealed carton complete with tubes and instruction manual, but less dynamotor. $12.95

IFF RADIO RECEIVERS

Signal Corps, complete with 13 tubes, Model BC-906-A—only $9.95

MARKER BEACON RECEIVER—AIRCRAFT

Complete with 2 tubes and sensitive relay to control external circuits from received signals. The receiver to control models, open doors from a distance, etc. Special $4.95

COMPLETE 4-TUBE INTERPHONE AMPLIFIER

Comes in an aluminum cabinet, 9¾x4¾x5½ inches with two 12J5GT and two 12A6 tubes; also Electric Dynamotor 28DC Volt input and 250 V DC output at 60 MA. Yours for only ... $7.95

RADIO TRANSMITTER AND RECEIVER APS-13

Light weight air-borne radar system, radio transmitter and receiver APS-13; tube complement: 5-6J6; 9-6AG5; 1-VR105; 2-D21; unit is brand new, complete with tubes, the tubes alone are worth more than this LOW PRICE OF ONLY $15.00

GLIDE PATH RECEIVER R-89/ARN-5

Glide Path Receiver used in the Instrument Landing System covering the frequency range 332 to 335 mc; complete with the following tubes: 7-6AJ5; 1-12SR7; 2-12SN7; 1-28D7 and including three crystals 6497KC; 6522KC; 6547KC—units are in A-1 condition for only $6.95

ARMY SURPLUS, principal components of radio set SCR-274-N; includes 2 transmitters, 3 receivers, 1 modulator, 4 dynamotors, control box, etc.—original cost over $800.00. NOW—complete $34.95

SCR-522 TRANSMITTER AND RECEIVER

The standard very-high-frequency airborne receiver-transmitter. 100 to 156 megacycles. 4 crystal-controlled channels selected from remote control box. In excellent condition—ONLY $19.95

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Designed to receive A-N beam signals. 24-28 vdc. 21.6 watts. Tube complement: 14H7 or 14A7, RF amplifier; 14H7 or 14J7, mixer; 14A7 or 14K7, IF amplifier; 14R7, detector and 1st audio amplifier; 28D7, output amplifier. 195 to 420 Kc. 4" high x 3" wide x 6¾" long—wt. 3 lbs. 14 ozs. Used—A-1 condition $4.95
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DYNAMOTOR DM 32A

Each $1.95

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Complete with 27 tubes including 5" Cathode Ray Tube—used—each $24.95

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Complete with 29 tubes including 3" Cathode Ray tube—used—each $24.95

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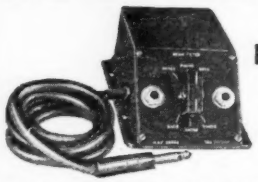
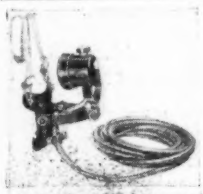


REDUCE C.W. QRM!

X-315 AIRCRAFT RADIO BEAM FILTER

Filter tuned to 1020 cps. and can be used to eliminate interfering C.W. signals. Used with aircraft receivers, to fly radio marker beam, or receive voice signals from marker beam stations.

BRAND NEW **$4.50**



M-110 WESTERN ELECTRIC SOUND POWERED MICROPHONES.

Complete with chest-plate & 20 ft. of high grade mike cable, $6.50. With 50 ft. length of cable $7.50.

BRAND NEW

SPECIAL ASSORTMENT OF FIFTY RESISTORS

Containing: 5 watt w.w., 5-100 ohm, 4-200 ohm, 6-4000 ohm, 1-600 ohm, 4-500 ohm; 10 watt w.w., 10-10,000 ohm, 2-400 ohm, Tap, 50 ohm, 1-40 ohm, Tap, 10 ohm; Cartridge w.w., 1-4000 ohm, 20 w., 3-400 ohm, 1w.; 15 Assorted Carbon Resistors.

COMPLETE ASSORTMENT for ONLY $4.00

ALTEC LANSING SPEAKERS, AMPLIFIERS & TRANSFORMERS. MAGNETIC WIRE & TAPE RECORDERS... SOUND EQUIPMENT

SEND for our BARGAIN FLYER

30% Deposit with COD's. Min. Order $3.00. Many other items & specialties. Quality sound & recording equipment.

CLARION SOUND ENGINEERING CO.

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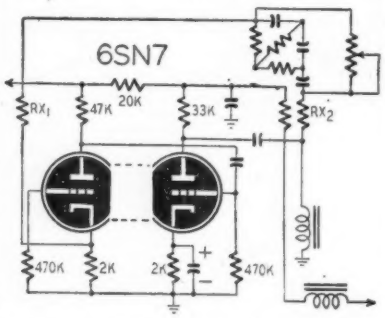
Phone: Gibralter 7-8975

RECORDING AMPLIFIER

In perusing my article: "Small Recording Studio, Part I" I find the resistor values in the 6SN7 voltage amplifier are incorrect as printed. I am enclosing a correct circuit diagram for the amplifier, together with an additional feedback resistor for use if a builder encounters oscillation in the tone control circuit. Rx1 and Rx2 should be from 20 to 30 thousand ohms each.



Good results will follow installation of Rx2 whether there is oscillation in the circuit or not. It should then be about 25,000 ohms.

J. C. HOADLEY,
West Newton, Mass.

If a television receiver refuses to work well, ten to one the fault is a poor antenna installation, say television service experts.

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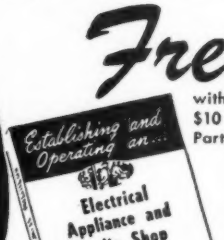

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BUILD YOUR OWN VOLT-OHM MILLIAMMETER!!

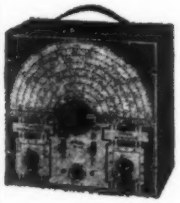
The model KT 20 kit provides *all* components, including meter, panel, cabinet, resistors, condensers, tip jacks, control, selector switch, copper oxide rectifier, precut wires—in fact every component and part needed to complete the unit.

THE KIT COMES COMPLETELY ASSEMBLED. Can be wired in 15 minutes. Components and circuit guaranteed to meet the following specifications:

4 A.C. VOLTAGE RANGES: 0-15/75/300/1500 volts.
4 D.C. VOLTAGE RANGES: 0-15/75/300/1500 volts.
2 A.C. CURRENT RANGES: 0-15/150 MA.
2 RESISTANCE RANGES: 0-10,000 ohms; 0-1 Megohm.

Complete kit including all parts assembled and ready for wiring, circuit diagram, easy-to-follow instructions and detailed operating data for the completed instrument.

Only **$9.50**



The New Model B-45 SIGNAL GENERATOR

Self-modulated—provides a highly stable signal. RF frequencies from 150 Kc. to 12.5 Mc. on Fundamentals and from 11 Mc. to 50 Mc. on Harmonics. Modulation is accomplished by gridblocking action—equally effective for alignment of amplitude and frequency modulation as well as for television receivers. Self-contained batteries. All calibrations are etched on the front panel.

Complete, ready to operate $27.75

The New Model 670 SUPER-METER

A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE INDUCTANCE and DECIBEL MEASUREMENTS.

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1500/3000 Volts.
OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000 Volts.
D.C. CURRENT: 0 to 1.5/15/150 Ma; 0 to 1.5 Amperes.
RESISTANCE: 0 to 500/100,000 ohms; 0 to 10 Megohms.
CAPACITY: .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics).
REACTANCE: 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms.
INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries.
DECIBELS: -10 to +18, 10 to +38, +30 to +58.

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

$28.40

The New Model CA-11 SIGNAL TRACER

Simple to operate . . . because signal intensity readings are indicated directly on the meter!

★ SIMPLE TO OPERATE—only 1 connecting cable—NO TUNING CONTROLS.
★ HIGHLY SENSITIVE—uses an improved Vacuum Tube Voltmeter circuit.
★ Tube and resistor-capacity network are built into the Detector Probe.
★ COMPLETELY PORTABLE—weighs 5 lbs. and measures 5" x 6" x 7".
★ Comparative Signal Intensity readings are indicated directly on the meter as the Detector Probe is moved to follow the Signal from Antenna to Speaker.
★ Provision is made for insertion of phones.

The Model CA-11 comes housed in a beautiful hand-rubbed wooden cabinet. Complete with Probe, test leads and instructions **$18.75**

The New Model 450 TUBE TESTER

Speedy operation—assured by newly designed rotary selector switch which replaces the usual snap, toggle, or lever action switches.

SPECIFICATIONS:

★ Tests all tubes up to 117 volts. ★ Tests shorts and leakages up to 3 Megohms in all tubes. ★ Tests both plates in rectifiers. ★ New type line voltage adjuster. ★ Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes. ★ Noise-Test — detects microphonic tubes or noise due to faulty elements and loose internal connections. ★ Uses a 4½" square rugged meter. ★ Works on 90 to 125 volts 60 cycles A.C.

EXTRA SERVICE—May be used as an extremely sensitive condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute **$39.50**

OUR POLICY

- We do not advertise any unit which is not available for *immediate shipment* from stock.
- Less flowery adjectives, more detailed specifications.
- All units are sold subject to one year guarantee except when components are damaged through misuse.
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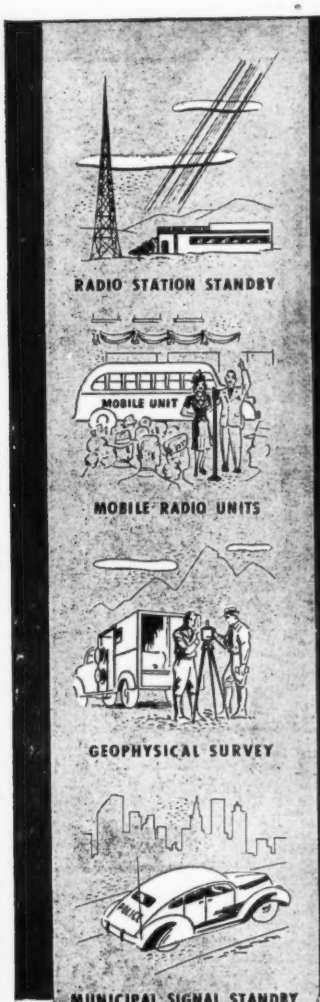

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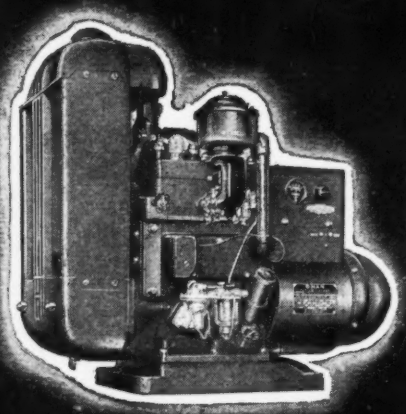


Onan Electric Plants are completely self-contained, dependable power units built in a wide range of sizes and standard voltages.

Lightweight, one or two-cylinder, air-cooled models offer the maximum in portability for many applications. Portable A.C. models—350 to 3,000 watts; portable D.C. models—600 to 5,000 watts.

Although widely used for intermittent service as standby units, Onan two, four, and six-cylinder water-cooled plants are built for continuous heavy-duty operation . . . stationary or mobile. A.C. models—3 KW to 35 KW; D. C. models—3.5 KW to 10 KW.

WRITE FOR FOLDER

ONAN Electric Plants are available in many sizes and models. ALTERNATING CURRENT: 350 to 35,000 watts in all standard voltages and frequencies. DIRECT CURRENT: 600 to 10,000 watts, 115 and 230 volts. BATTERY CHARGERS: 500 to 3,500 watts; 6, 12, 24 and 32 volts.

D. W. ONAN & SONS INC.

2437 Royalston Ave. Minneapolis 5, Minn.

NEW FRENCH RADIO PARTS

(Continued from page 40)

When you put the iron on its support a contact opens which puts an open-wound resistor in series with the heating element. The current decreases, remaining just sufficient to maintain the temperature of the iron.

Measuring apparatus

Contrary to the practice of previous years, measuring apparatus and test equipment was exhibited at the Parts Show. Before the war France was much

The 7½-inch potentiometer described below.

behind in this domain. But the technicians have done a very fine job in this field, and the measuring apparatus now presented compares well with foreign production. We particularly noted an impedance bridge—(5) on page 40—which permits the measuring of all the inductors and capacities over a very large range. The leading feature of the instrument is a potentiometer of which the diameter is 7½ inches and which makes it possible to obtain precision results.

Another highly interesting apparatus is a universal generator—(6) on page 40—which covers radio frequencies 50 kc to 50 mc with an output variable from 1 μv to 1 v, six different modulation frequencies and the possibility of functioning as a multivibrator to facilitate alignment of receivers.

To sum up, the French Radio Industry, despite all difficulties, is developing favorably.

ANOTHER SPECIALIST

Specialization in radio has reached such a level that even radio thieves are specializing, if a last month's report emanating from Britain is to be believed.

According to a story in the *Scottish Radio Trade Digest*, an unemployed truck driver, Robert A. Fisher of Norwich, stole a receiver from one radio shop and sold it to another dealer. Returning a couple of days later, he sold the dealer an electric iron, then on leaving left the door open so the bell would not ring. Returning a few minutes later, while the dealer was busy in the back of the shop, he re-stole the radio and decamped.

Specialization in crime does not go unrewarded. The brand-conscious thief was captured and sentenced to 12 months in jail. The cell is *not* to be radio-equipped.

NOW AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK!

THE NEW MODEL 670

SUPER-METER

***A Combination* VOLT-OHM-MILLIAMMETER *plus* CAPACITY REACTANCE INDUCTANCE *and* DECIBEL MEASUREMENTS.**

Added Feature: The Model 670 includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

Specifications

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts.
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts.
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts.
D.C. CURRENT: 0 to 1.5/15/150 Ma.; 0 to 1.5 Amperes.
RESISTANCE: 0 to 500/100,000 ohms; 0 to 10 Megohms.
CAPACITY: .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics.)
REACTANCE: 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms.
INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries.
DECIBELS: −10 to +18, +10 to +38, +30 to +58.
Housed in a rugged, crackle-finish steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

$28.40

PLEASE PLACE YOUR ORDER WITH YOUR REGULAR RADIO PARTS JOBBER. IF YOUR LOCAL JOBBER CANNOT SUPPLY YOU, KINDLY WRITE FOR A LIST OF JOBBERS IN YOUR STATE WHO DO DISTRIBUTE OUR INSTRUMENTS OR SEND YOUR ORDER DIRECTLY TO US.

SUPERIOR INSTRUMENT CO., 227 Fulton St., Dept. RC-5, New York 7, N.Y.

and convert them into the necessary high voltage. A pair of parallel tubes are placed across the deflecting coils to damp out any oscillations after the retrace period. A centering control is contained in the same circuit. It functions as previously described.

Note that this power supply does not depend upon oscillations in the transformer (since none occur), but only on the high voltage which is developed during the retrace interval. In 1 second, 15,750 of these peaks occur. The problem of filtering these from the final d.c. output voltage can be readily solved by the addition of a 500-μμf condenser and a bleeder resistor.

A voltage doubler circuit

Cascading rectifier tubes to obtain the desired high voltage is not usually attempted in conventional units. In the circuit of Fig. 6, the 8016 tubes are connected so that their plates receive the same potential, at the same time, from the primary of T1. If we trace the flow of current through the first 8016, we find that the electrons flow down through the primary, through the low-voltage power supply to ground, and then up through C1 to the cathode of the 8016. In this way, C1 becomes charged to essentially the peak voltage of the retrace pulse appearing across the primary of T1. The polarity of the voltage across C1 is as indicated, with the ground end negative and the other plate positive. Let us assume that this peak voltage is 5,000 volts. Actually it may be higher, depending upon the design of T1.

TELEVISION FOR TODAY
(Continued from page 50)

The plate of the second 8016 also receives the same pulse potential. Under the impetus of this force, electrons flow through the tube, down through the resistor R1, through C2, and back to the tube. Current flows until the condenser C2 is charged to the peak applied voltage. Note the polarity of the charge across C2. If a connection is made to the cathode end of C2, the voltage existing between this point and ground is the sum of the peak voltages of C1 and C2. Since they are series aiding, 10,000 volts is available between point *A* and ground. A bleeder resistor chain from point *A* to ground will make available additional voltages for the focusing and accelerating electrodes of the cathode-ray tube. Separate filament windings for the 8016 tubes are necessary because of the different d.c. potentials on each. In this instance, under the conditions assumed, each differs by 5,000 volts from the other.

For projection tubes, it is customary to design T1 for a peak pulse voltage of 7,500 volts. Then, four 8016's are connected in cascade, and the output potential is 4 × 7,500, or 30 kv.

Typical voltage regulation curves for the two types of high-frequency power supply are shown in Figs. 7 and 8. According to the standards of conventional low-voltage 60-cycle units, the regulation of the high-voltage supplies is not good. However, the current requirements of the cathode-ray tube are small and the variation in current during op-

(Continued on page 78)

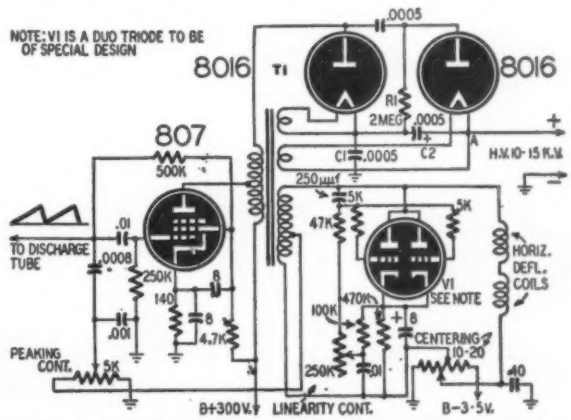


Fig. 6—An "inductive-kick" type of voltage-doubling power supply.

METROPOLITAN'S 4 GREAT VALUES!

The New Model 111 AC-DC QUALITY MULTITESTER

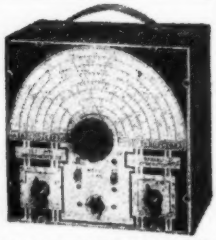
A new pocket-size volt-ohm-milliammeter with features never before available in an instrument of this size and price.

D.C. Voltmeter: 0-5-50-250-500-2500 volts. A.C. Voltmeter: 0-10-100-500-1000 volts. Output Voltmeter: 0-10-100-500-1000 volts. D.C. Milliammeter: 0-1-10-100 milliamperes. D.C. Amperes: 0-1-10 amperes. Ohmmeter: 0-500-100,000 ohms; 0-1 megohm. Decibel Meter: -8 to +55 db. The scale is calibrated for line of 500 ohms impedance. For other impedances correction charts are supplied.

Model 111P, in portable case (not illustrated) including testing leads and complete instructions **$19.85**

Model 111A, open face, as shown, complete with instructions **$16.85**

The New Model B-45 Battery Operated SIGNAL GENERATOR



for servicing AM, FM and Television Receivers. R.F. frequencies from 150 Kilocycles to 50 Megacycles (150 Kc. to 12.5 Mc. on Fundamentals and from 11 Mc. to 50 Mc. on Harmonics). Complete with shielded test lead, self-contained batteries and instructions.

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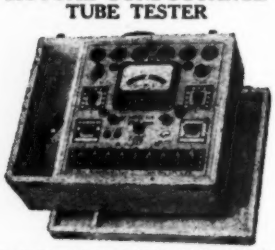
The New Model 200 MUTUAL CONDUCTANCE TUBE TESTER



A tube tester with complete flexibility. Unfailing accuracy in classifying tubes under test on the REJECT-GOOD scale. Absolutely NO DANGER of BAD tubes reading "good" and GOOD tubes reading "bad." Tests all tubes from .75 volts to 117 filament volts.

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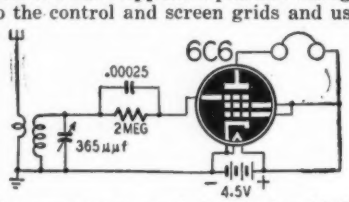
RADIO·ELECTRONIC CIRCUITS

LOW-VOLTAGE RECEIVER

Here is a circuit of a low-voltage receiver that I find to be sensitive and selective. I have applied a positive voltage to the control and screen grids and use



the suppressor as the control grid. In this way, the set works with only 4.5 volts on the various elements.

EMMITT A. BARNES, *Gulfport, Miss.*

(This is a type of space-charge detector. Performance may be improved by using a 6-volt battery.—*Editor*)

CARRIER TRANSCEIVER

I get good results with the following 4-tube carrier-current transceiver. The transmitter is a 6SJ7, suppressor-modulated by a 25L6. For receiving, a 6SJ7 regenerative detector works into the 25L6, which has a pair of headphones switched into its plate circuit. A 50-mh r.f. choke and a pair of 500-μμf condensers prevent r.f. voltages from entering the a.f amplifier and power supply.

The transmitting coil consists of 160 turns of No. 28 enamel wire on a 1½-inch form with a tap taken off at 50 turns from the bottom end. All of the receiver coils are wound on a common 1½-inch form with No. 32 enamel wire. The grid coil L2 is wound with 300 turns and covered with a thin layer of tape or waxed paper. L4 has 100 turns wound over the grid end of L2, and the tickler L3 has 75 turns wound close to the ground end of L2.

Bias for the suppressor grid is supplied through a 220,000-ohm resistor and a bias battery. The battery voltage may be adjusted by listening to the signal on another transceiver and adjusting for highest modulation strength with least distortion.

H. O. NORTHERN, *Chattanooga, Tenn.*

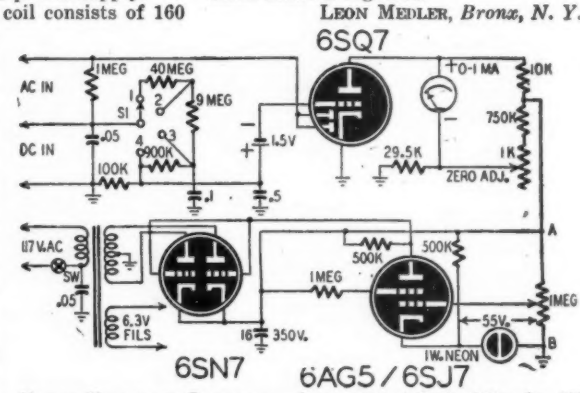
A.C.-D.C. V.T.V.M.

Here is a circuit of a vacuum-tube-voltmeter that I have found useful for measuring a.c. and d.c. voltages up to 500 volts. A 6SN7, a 6AG5, and a 1-watt neon lamp are used in a voltage-regulated power supply, and a 6SQ7 acts as meter amplifier and rectifier.

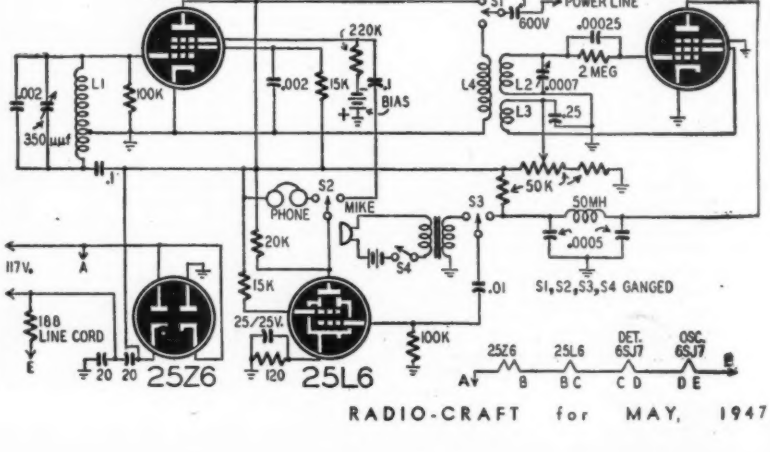
The 6SN7 is connected as a grid-controlled rectifier with its grid voltage derived from the output of the supply. Any changes in the output voltage are neutralized by changes in the internal resistance of the rectifier. A 6AG5 was used as the voltage regulator, but a 6J7, 6K7, and similar tubes can be used with equal results. The bias on these tubes is critical and should be adjusted to give 250 volts between A and B.

When the ranges are changed, the meter should be brought to zero by adjusting the 1,000-ohm control with the leads shorted together.

LEON MEDLER, *Bronx, N. Y.*

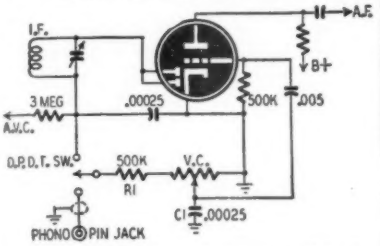


Above—The v.t.v.m. Ranges are—from points 1 to 4—500 volts, 100 volts, 10 volts and 1 volt. Below—Carrier-current transceiver.



ADDING A PHONO PICKUP

Many commercial radios are fitted with phono input jacks that connect directly to the grid of the first a.f. stage without a volume control. These sets are rewired as shown. R1 (50,000 to 500,000 ohms) decreases the phono input to approximately the same level as the output of the detector and the 0.00025-μf r.f. filter condenser between the arm of the volume control and ground serves as a high-frequency scratch filter.

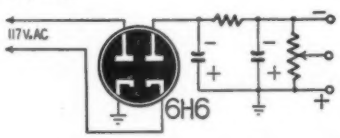


In some sets, the volume control is the entire detector load. In this instance, a 500,000-ohm resistor may be connected in the hot lead of the phono input circuit.

FRED W. RODEY,
Berwyn, Ill.

SAFETY POWER SUPPLY

Here is a system that I use to obtain d.c voltages from an a.c. line without using a transformer or having one side of the line connected directly to the chassis—undesirable in many applications. It is useful in supplying fixed bias for amplifiers and transmitters and other applications where up to 120 volts is required.



The filter constants will depend on the amount of filtering required.

In the circuit shown, the chassis is positive. The polarity may be reversed by reversing the connections to each diode section. Any double diode such as a 25Z6, 50Y6, or 117Z6 may be used as long as the correct heater voltage is applied. The 6H6 may take its heater voltage from the 6.3-volt line of an amplifier or transmitter and will work well in circuits where its current ratings are not exceeded.

JOHN A. DEWAR,
Bancroft, Ont., Canada

CLEANING CONDENSER PLATES

Condenser plates of the present-day radio are so closely spaced that we can no longer use the old stand-by (a pipe cleaner) for cleaning them.

Wash between the plates with white gasoline, using a soft-bristled brush. A good absorbent photographic blotting paper, cut into strips about ½ inch wide, is then passed between each pair of condenser plates. This absorbs the unevaporated gasoline along with any dirt which may be present.

C. J. WHITTON,
Denison, Texas

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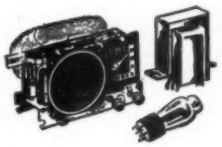

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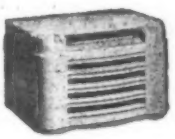

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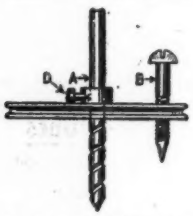
An efficient circle cutter for light metal and wood can be made from a pulley from an old Atwater Kent radio. These pulleys were used to gang two or more variable condensers mounted on the panel.

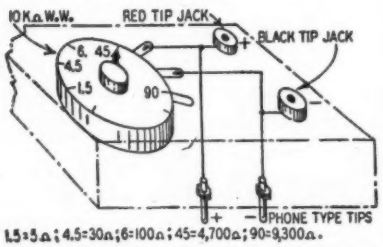
A ¼-inch twist drill is inserted in the center hole and the set screws tightened to hold it in position. A small bolt, selected to make a tight fit in one of the holes near the outer rim of the pulley, is ground to a triangular point for cutting. One nut is run up on the bolt before it is inserted in the hole and another is run up from the bottom to hold the bolt in place. The length of the bolt can be adjusted by changing the position of the two nuts. If a larger pulley is available, the bolt may be placed in holes drilled at different distances from the center so that several sizes of holes may be drilled.



JOHN HAYNES,
Doe Run, Missouri.

BATTERY TESTER

I have constructed a convenient load for testing dry batteries. It consists of a 10,000-ohm potentiometer housed in a small box fitted with pin terminals or phone tips along its bottom edge. The tips are spaced so that they will fit into the voltage jacks of the tester. Pin jacks, for test leads, are mounted in the top of the box. The dial of the potentiometer is calibrated directly in standard battery voltages. Resistance values are shown in figure below.



1.5=5.a; 4.5=30a; 6=100a; 45=4,700a; 90=9,300a.

Standard Voltage	*Resistance Ohms*	*Current Ma*	*Min. Service Voltage*
1.5	5	300.0	1.2
4.5	30	150.0	3.6
6.0	100	60.0	4.8
45.0	4,700	9.6	36.0
90.0	9,300	9.7	72.0

The table also gives the normal current that is drawn from batteries under load and the minimum service voltage. This voltage is 80 percent of the normal value, and is the discard point.

WILLIAM B. THORNE
St. John, N.B., Canada

REPLACEMENT TRANSFORMERS

Replacement power transformers with 6.3-volt filaments are often hard to find. Distributors sometimes have a large stock of power transformers with 2.5-volt filament windings. These may be used instead by connecting one side and the center tap of the 2.5-volt winding in series—aiding with the 5-volt rectifier winding to give 6.25 volts. Other transformers are designed for use with 1.5-volt tubes. These can be made to give the necessary filament voltage by connecting the 1.5-volt and 5-volt windings in series. In either case, the rectifier tube may be replaced with a 6X5 or similar tube.

CARL G. BLANYER,
Houston, Texas

PROTECTING DRAWINGS

When constructing a piece of apparatus from a schematic drawing which you do not want marred and wish to save, it will help if you cover the diagram with a sheet of tracing paper tacked to your workbench or held on a clip board. In this way connections may be crossed off on the tracing paper as they are wired and the drawing will remain clean. This is especially helpful when building several copies of the same circuit, as the paper can be changed easily and always may be checked against the original schematic.

PAT CLEMENS,
Columbus, Ohio

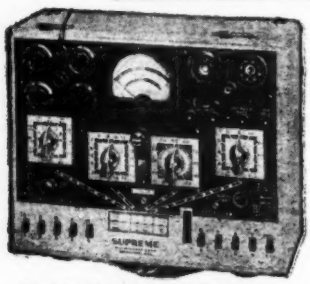
NEW SIGHT FOR MAGIC EYE

Life can be restored to electron-ray indicator tubes such as 6U5, 6G5, and 6E5, provided the filament is in good condition. Rotate the tube slowly over the flame of a candle for about 3 minutes and allow it to cool slowly in an area free from cold drafts. The tube will glow more brightly, though not as brightly as a new tube.

Other types of tubes can be given a new lease on life in the same manner.

JOHN POTTER,
Lebanon, Conn.

3 WAYS TO BE AHEAD in Buying Test Equipment



Model 599-A Tube and Set Tester

SPECIFICATIONS
DC Volts — 5 ranges 0/6/15/150/600/1500 volts. 1000 ohms per volt.
AC Volts —3 ranges 0/15/150/600 volts.
DC Current — 3 ranges 0/6/60/600 milliamps.
Output Volts—0/15/150/600 volts.
Ohmmeter — 4 ranges 0/200/20,000 ohms and 0/2/20 megohms.

Condenser Checker—Ohmmeter provides fast method of checking leakage of both paper and electrolytic condensers.
Battery Tester — Tests most commonly used dry portable batteries of 1.5/4.5/6.0/45/90 volts. English reading "No place-Good" scale.

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2 BUY DEPENDABILITY
3 BUY SUPREME-ACY

Ask your nearest SUPREME jobber for a demonstration of Model 599-A Tube and Set Tester (above), Model 561-AF & RF Oscillator, Model 546-A Oscilloscope, Model 592 Speed Tester. Ask to see the complete line of SUPREME equipment.

SUPREME

Tube Testing — Circuit incorporates proven and modernized emission circuit. Checks for short, leakage, and noise tests between elements.
Power Supply—100-133 volts—50/60 cycles. Special voltages and frequencies on request.

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Export Departments: THE AMERICAN STEEL EXPORT CO. Inc., 347 Madison Ave., New York 17, N. Y., U.S.A.

AN ECONOMY TRANSMITTER

(Continued from page 21)

on 1½-inch, low-loss forms. The 10-meter coil is 1½-inch in diameter and may be mounted on an old tube base.

AMPLIFIER COIL TABLE

BAND	TURNS	WIRE SIZE	WINDING SPACE
80	30	No. 16 en.	4 inch
40	20	No. 12 tin.	3½ inch
20	10	No. 12 tin.	3½ inch
15	8	No. 12 tin.	3 inch
10	6	No. 10 tin.	3 inch

These coils are center tapped and wound on ceramic forms 2½ inches in diameter. The link coils L2 are wound with well-insulated wire around the center of L1. The number of turns is adjusted to load the final amplifier fully with a low-impedance line attached.

Phone operation

If low- or medium-mu tubes are used in this circuit, they may be cathode-modulated with only 20 watts of audio power. Any conventional amplifier supplying this power may be used if its output transformer has a 500-ohm secondary. This is connected in series with the filament center tap and ground as shown in Fig. 2. If the audio quality is mushy, the filament by-pass condensers should be reduced to .003 or .002 μf.

Any power supply capable of giving the correct voltages with good regulation may be used. Fig. 3 shows the one actually employed with this transmitter. Switch S-1 is the exciter switch, S-2 filament switch for high-voltage rectifiers and S-3 the plate power switch. The switches are interlocked so that high voltage cannot be applied to the 866's till the filaments are hot.

With a little ingenuity and a well-stocked junk box, the average ham can duplicate the performance of this rig at similar or perhaps lower cost.

TRANSATLANTIC NEWS

(Continued from page 38)

has shown that the ionization of the E-layer—on which nighttime long-distance medium-wave reception depends — is maintained by the arrival of meteors and meteoric dust in the upper atmosphere. Analysis of the radar echoes shows that meteors and meteoric dust would produce exactly the effects observed. The work done also clears up another point which had up to now never been satisfactorily explained. Every dx fan knows by experience that the behaviour of the E-layer is much less liable to eccentricities in the latter part of the night. This is because, wherever he may be, an observer is after midnight on the forward side of the earth as it moves along its orbit. When you walk fast through rain your face becomes wetter than your back because it is driving into the stream of raindrops. Similarly the forward side of the earth receives more meteors and meteoric dust than the other and the E-layer covering it is more strongly affected by their arrival.

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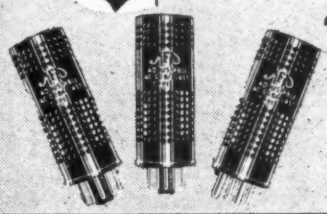

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"C" Ballasts	All 4 prongs	80 through 350	R, R4, R8, L, L4, L8

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½ MEG. volume control with switch and long shaft, ea. 59c — 6 for $3.25

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100 Insulated Resistors, ½, 1 & 2 Watt $1.95
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20 Assorted Tube Sockets 1.00
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.02	.08	6.50
.05	.10	8.00
.1	.12	9.00
.25	.17	13.50
.001	.08	6.50
.002	.08	6.50
.005	.08	6.50
.006	.08	6.50
.5	.26	22.50

"Illinois" Electrolytics

Mfd.	VDC	Price
10	25v	.25
100	25v	.55
12	50v	.38
16	150v	.35
20	150v	.38
24	150v	.38
30	150v	.40
50	150v	.50
8	450v	.38
10	450v	.43
16	450v	.55
20	450v	.60
40	450v	.88
100	15v	.49

"Illinois" Duals

16-16	150v	.58
20-20	150v	.65
30-30	150v	.70
40-20	150v	.70
50-30	150v	.76
8-8	450v	.65
10-10	450v	.70
20-20-20	150v	.99

10% discount on all electrolytics if purchased in lots of 10 or more. Mica Condensers, all sizes, 8c each.

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Model 670 Superior Voltohmmeter $28.40
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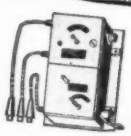
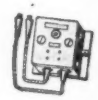


2-Channel box for intercom. PA, Ham work. Parts alone worth many times the price! 3-12 pt. rotary switches, 1-double deck, 2-triple deck, 12 pt. recessed male connector, pilot light, socket and bulb with translucent red cover, ¼ watt resistor, 3 pointer knobs, 3-3 ft. cables, 5 pt. female terminals. All in dual metal box 10 x 4 x 2". A hot buy for only..... **49¢**

SINGLE CONTROL BOXES



5 x 4 x 2". Two 3-deck, 12 pt. rotary switches, pilot light, 2-12 pt. recessed male connectors, 3 ft. 5-wire cable. With 2 bakelite knobs. Great Value! Only..... **39¢**

SINGLE BOX, as above, but with one rotary switch, 2-3 ft. 5-wire cables. Only..... **39¢**

SINGLE BOX — Push Button, high frequency buzzer, 2-3 ft. 5-wire connectors and several terminal strips. Parts alone worth twice as much. Only **39¢**

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1C21	$ .75	6J4	$1.50	250TH	$9.00	808	$3.00	830B	$5.25	872A/872	2.25	958A	$ .75
1N21A	.20	10Y	1.50	304TH	12.00	809	1.50	832A	4.05	884	.75	959	.75
1N23	.20	35TG	1.95	304TL	3.75	810	2.63	836	1.50	921	.75	1616	3.00
2AP1	2.25	75TL	2.25	715C	33.00	811	1.95	837	3.38	922	.73	1619	.75
2C40	2.63	VR90	.75	800	2.25	813	6.75	838	3.75	923	.45	1624	.90
2C44	1.50	100TH	4.13	801A	1.73	814	4.50	843	.75	927	1.05	1625	.75
2D21	.60	VR105	.75	802	1.58	815	2.25	845W	3.75	931A	1.88	1626	.60
2X2/879	.90	VR150	.75	803	9.00	816	.60	860	3.00	954	.75	1629	.27
3AP1	3.00	204A	60.00	804	6.75	826	2.25	861	90.00	955	.75	2051	.90
5AP1	9.00	211	1.13	805	3.75	828	9.00	864	.60	956	.75	8005	3.15
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PHONE and MICROPHONE ASSEMBLY

Dynamic type, adaptable for code practice sets, mobile equipment, PA systems, home recording, etc. Mike handset with 50-ohms impedance. Mike and Phones terminate in 5-wire male plug, 3 ft. cord with female receptacle facilitates disconnection. Special Value at Only..... **$1.95**

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A rare bargain! Brand New, High Fidelity, Famous Make crystal pickup. Featherweight, Tangent Head, 7" mounting center. While they last, only **$1.99**

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NATIONAL

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HQ-129X complete	173.25
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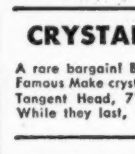

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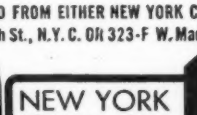

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A WATER WATTMETER

Accurate microwave measurement with a high-frequency water calorimeter, which indicates r.f. power in terms of temperature rise of water through which v.h.f. waves are passed, is revealed by the Polytechnic Institute of Brooklyn.

The newly-invented device is important with the increasing use of very high frequency radiation in airplane approach-control, television, radar, and frequency modulation broadcasting.

It will enable engineers to improve the design of high-frequency equipment for specific distances because it accurately measures the power of the radiation.

KING OF TUBE CHECKERS

(Continued from page 22)

units are designed to provide a maximum of 100,000 volts and 1 ampere.

In switching such high voltages, it was necessary to develop a special means of applying and disconnecting the power to the tube under test. This unit consists of a double-sphere gap. The spheres are adjustable to obtain the desired voltage breakdown value. The triggering voltage for this sphere-gap switch is obtained from a separate rectifier unit which provides approximately 50 kilovolts to the center sphere to initiate the arc discharge.

During the operating cycle the arc is turned on and off at 60-cycle and approximately 1000-cycle rates. After the arc is initiated by the triggering gap, it will continue as long as voltage is applied. To stop the arc discharge and remove voltage from the tube, a stream of high-pressure air is directed at the sphere gap by an automatic switch at the instant it is desired to remove voltage.

All these high-power arcs of course develop an excessive din. To reduce the noise as much as possible, a special soundproof box is mounted around the sphere gap. The high-voltage supply to this test equipment has a solid metal enclosure installed to protect the operating personnel from harmful X rays originating from the rectifier tubes. The maximum number of safety devices must be installed for the protection of the operator.

EFFICIENT TEST AND REPAIR BENCH

(Continued from page 22)

the rear. Four duplex receptacles in the base of the instrument panel have been placed in the most logical positions. The soldering iron plugs into an outlet under the working surface so the iron can be used anywhere on the unit without dragging the cord under or over obstacles. Outlets in the rear of the panel for instruments bring up the total to eight. All wiring is shielded and can be grounded.

5. Last but by far the least of our problems is to incorporate all of these ideas into an attractive piece of equipment. The Ser-V-Lux is a smooth, streamlined, custom-built unit, finished in a soft white duco set off with satin finished aluminum trim and hardware.

We have used two of these units for eighteen months in an actual radio service business, and the results are beyond expectation. Business has increased and the comments of customers are highly satisfying.

More than 300,000,000 phonograph records were manufactured in 1946, according to Wm. C. Speed of Audio Devices, Inc. This figure, Mr. Speed says, triples the pre-war output. He predicts a larger output for 1947.

PROMPT SERVICE ON ALL SPEAKER AND PHONO PICK-UP- REPAIRS

MAY LEOTONE SPECIALS

Minimum Order $2.00—20% Deposit Required on all orders. Please Add Sufficient Postage. WRITE DEPT. RC-5.

DEFLECTION YOKE for 5" cathode ray tube. Fully shielded. 1½"I.D., 3" sq. 2.49
DYNAMOTORS (Navy Dy-9) DC input: 26V, DC output:360V@135MA or 310V@355MA. Black crackle finish, with mtg. base 6½"x3½" .. 3.95
Co-axial Cable. RG-13/U. 74 ohm, double copper braid, outside vinyl jacket. .420" O.D. with 2 connectors. 20 ft. lengths 1.69
PHONO MOTORS!—110V. A.C. quiet rim-drive motor and 9" flocked turntable 2.95
12" Turntable Felts. Brown or green ..... .23
Brand new RCA UX-200 tubes in sealed cartons. Ideal triode detector, 8 for 1.00
TUBES: Perfect condition, but not in sealed cartons. Guaranteed for 90 days. #26, 27 or 56 ..... .29
#24, 42, 45, 75, 77, 78, 80, 5Y3, 6H6, or 6K7 ..... .39
#6A8, 6C5, 6F5, 6J7, 6SA7, 6SK7 or 12SA7 .49
#1A7, 6A3, 6G5/6U5 or 50 ..... .59
SPEAKER GRILLES, 5½" sq. Flocked musical design on gilt perforated metal ..... .10
Speaker Grille Cloth, gold or silver weave, sq. ft. .20
SELSYN SYNCHRO-TRANSMITTERS, 115V, 60 cycle. Used in pairs as trans. & follower. 3½"x5"—in pairs 3.75
SELSYN Control Transformers (#2J1G1) 57.5—57.5V, 400 cycle. 2¼ x4" 1.95
Wall Toggle Switch (C-H). S.P.D.T., 3A/125V ..... .39
RADIOMAN'S HARDWARE TREASURE. Approx. 1000 screws, nuts, washers, etc. ..... .49
Clear ACETATE for dials, windows, etc. (.015"): 3"x3"—.10 7"x7"—.45 12"x12"—.98 5"x5"—.25 9"x9"—.65 sheet 22"x55"—2.89
EXPERIMENTAL TUBES .20 assrtd. sizes & base types for testing, research, etc. Pri. tested 1.00
Victor Power Transformer f.r models R-32, 45, 52 or 75. Unshielded 5.95

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#1—Bar, ¼"x¼" (Max length 4") Per inch 5.12
#2—Face 1¼"x1¾"x⅞" high 9
#3—Heavy duty bar, 2½"x1⅝"x5/16" ..... .98
#4—Face ¾"x1½"x⅝" high ..... .35
#5—Polished, ⅞"x9/16"x⅝" high ..... .35
#6—Polished bar, 9/16"x¼"x⅛". 20 for 1.00
#7—Face ½"x1½"x⅝" high ..... .10
#8—ALNICO V,h'shoe, poles ⅝" sq. 1¼" high .7.
#9—ALNICO V,h'shoe, poles 9/16" sq. 1½" high ..... .98
#10—ALNICO V,h'shoe, poles 1"x1½"x2¾" high 5.95
#11—Horseshoe ea. pole 11/16" O.D., 2¼" high 1.29
#12—(Similar to #5) ¾"x⅜"x7/16" ..... .35
#14—Polished hvy duty bar, 3"x1¼"x⅞" (magnetized lengthwise, wide or narrow sides) 1.29
#15—Polished Block, 3"x2¾"x1½" Magnetized wide or narrow sides. (wt. 3 lbs.) 2.47
Unmagnetized 1.95
#16—Flat Bar, 1⅞"x15/16"x5/16" thick. ⅛" groove each end ..... .49

SERVICEMEN'S KITS

#1—R.F., Antenna and Osc. coils, 10 assrtd .98
#2—Speaker Cones; 12 assrtd. 4" to 12" moulded and free-edge (magnetic inch Less voice coils 2.00
#3—BAKELITE MICA CONDENSERS; 50 assrtd. .00001 to .2mfd. 200-600WV. clearly marked 2.95
#4—Tubular By-Pass Condensers; 50 assrtd. .001 to .05mfd. 200-600WV. Standard brands 2.49
#6—Dial Scales; 25 assrtd. airplane and slide-rule (acetate and glass included).. 2.98
#7—Escutcheon Plates; 25 assrtd. airplane, slide-rule and full-vision types 2.95
#8—Knobs; 25 assrtd. wood and bakelite, incl. push-on, setscrew and push-button types 1.00
#9—Wafer Sockets; 12 assrtd. 4 to 7 prong .25
#10—Voltage Dividers; 10 assrtd. standard, multi-tapped. Hi-wattages included 1.98
#11—Shield Cans; 15 assrtd. for coils, tubes, transformers, etc. 1.00
#12—Mica Padders and Trimmers; 15 assrtd., incl. multiple and ceramic base types .. .69
#14—Volume and Tone Controls; 10 assrtd. wire-wound and carbon. Less switches.. 1.49
#15—Wire-wound Resistors; 15 assrtd. ohmages, 5 to 20 watts; incl. enameled and candohms ..... .98
#16—I F Coils; 6 assrtd., including shielded and slug-tuned. Peaks unmarked 1.95
#17—Dial Windows; 12 assrtd. sizes, incl. flat and moulded acetate and convex glass 1.29
#18—Bakelite Coil Forms; 18 assrtd. popular sizes up to 3" diam. ..... .98
#19—Hitch Resistance Units; 25 assrtd. carbon, ferrule-ended. 25000 to 5 megohms. .49
#20—SPEAKER REPAIR KIT. A real money and time saver. Contains: 20 assrtd. paper rings, 10 spiders, 25 assrtd. voice coil forms, 3 yds. felt strips, 20 chamois leather segments, kit of 16 shims and tube of spkr. cement. All for 2.49
#21—Metal Cased By-Pass Condensers; 20 assrtd. paper-wound, multi-section; 200-400WV ..... .98
#22—Resistor Assortment; 20 carbon and wire-wound, 1/3 to 3 watts ..... .49

Filter Choke, 15 henry, 1200 ohms DC, 50ma. 2"x1⅝"x1⅝" ..... .49
4 TUBE AMPLIFIER (2-7C5, 7F7, 7Y4). Used as electronic supercharger control. 110V, 400 cycle. Black crackle finish case & slide-in chassis. Contains: power trans, 7 mica & oil cond, 7 resistors, 4 loctal sockets plus other components worth several times the price. 8¾"x 4½"x3¾". Less tubes 1.49

"Quncer" INPUT Transformers (⅞" x1 3/16") #56: Carbon mike to grid; #59—Dynamic mike or low impedance pick-up to grid; either 12 for ..... .49 5.00

ALUMINUM PANELS (.072"): 8" x 6" ..... .39
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BAKELITE PANELS: ⅛" glossy brown. 7"x10" .89
7"x14" ..... .69; 7"x18" ..... .79; 9"x14" ..... .85
⅛" Linen Bakelite Strips, 1½"x1½"—3 for ..... .25
PRECISION RESISTORS, plus/or minus 1% wire-wound. Ohmages: 2.35, 11, 24.5, 100, 840, 7800 30K, 50K or 400K ..... .35
Frequency Meter tech. manual (Navy) Theory & operations, 39 illust.&diagrams. 58pp ..... .15
"FM" Tech. Manual (Army) Theory, maintenance, operation. 86 illust, 49 diagrams, 240pp ..... .39

HEADBANDS (HS-33) with PL-54 plug & cord .39
PL-54 plug & 13" tipped double phone cord ..... .19
JK-26 ext. jack for PL-54. Bakelite shell .... .23
HEADPHONES — Army HS-33,2000 ohms, Leather covered, adj. forks. With PL-54 plug 1.25
Rubber phone cushions for above, per pair ..... .20

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MAKERS OF CONES AND FIELD COILS
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12,000 SQ. FT. OF RADIO PARTS

a hillside. The idea of making the whole laborious journey again was heart-breaking. He decided to ask for help through his radio, which had come through unscathed. He contacted headquarters, and planes were sent to biscuit-bomb him with supplies, with which he was able to finish the job.

There are two control stations. At Mount Stromlo, the Commonwealth Solar Observatory, is a small 50-watt transmitter, keeping constant touch with the widely-spread forest patrols. A 500-watt station in Canberra controls Mount Stromlo and also keeps in touch with the engineers maintaining roads and bridges and with all the vehicles that work about the town itself.

The main control station

The network call sign is VJA6, and control is carried on from the Canberra power station, some hundreds of yards from the main transmitter, to which it is connected by remote control. The main transmitter is a crystal-controlled unit, operating on 2.86 megacycles, and consists of a 6L6 oscillator, link-coupled to two 805's, link-coupled to tuned feeders, current feeding a full-wave antenna approximately 120 feet in height.

The 805's are operating under 1,580-volt plate-modulated conditions, and have no difficulty in putting a 500-watt signal on the air. Filaments are in "stand-by" at all times, permitting immediate operation by remote control at the power station. The modulated output is obtained from two 805's in class-B, working in 1250-volt conditions. Power supply is from the mains.

CANBERRA'S MOBILE RADIOS

(Continued from page 34)

The main receiver has a crystal-controlled oscillator frequency and uses the transmitter antenna. The output can be switched from the speaker to a T-filter network (1000 cycles), operating an electric relay and bell-call system. This power supply also comes from the mains.

Cars carry a transceiver unit, whose transmitter sections consist of an 1F5 crystal oscillator (2.86 megacycles), capacity-coupled to a plate-modulated, shunt-neutralized twin triode, 1J5G, used as a single triode. There are approximately 200 volts at the plates, and the output is approximately 2 watts.

The modulator section consists of a carbon microphone feeding a 1F5, and transformer-coupled to a 1J6G in class-B, working at about 160 volts. A 1,000-cycle generator is incorporated, to permit transmission of the call note.

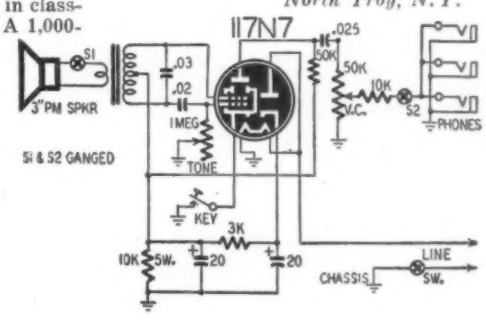
The receiver section is crystal-controlled and has a reflexed i.f. stage and grid-leak detector, with a 1F5 operating at around 150 volts, driving a midget speaker. The power supply of the whole transceiver is from a 6-volt storage battery and a vibrator.

The cars have fishing-rod aerials for general use. These give satisfaction up to approximately twelve miles, after which it is necessary to use the sectionalized thirty-foot pole provided, which permits operation over a distance of fifty miles.

CODE OSCILLATOR

Presented herewith is a circuit of a code-practice oscillator that can be used with a speaker or several pairs of headphones. It uses the amplifier section of a 117N7 as a Hartley oscillator, using a push-pull output transformer as the inductance. A 1-megohm variable grid leak provides variable tone control. No volume control is used on the speaker, but one may be added if desired. Jacks are provided for several pairs of phones, which are connected in parallel. A volume control in the output circuit sets the volume level to the phones.

CALVIN SMITH,
North Troy, N. Y.



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Yep!—we've just added an entire five story building to enlarge our present facilities. More space to display all the fine lines we distribute—more room in which you can shop in comfort—a sparkling new Harrison Select Surplus section—a real Ham Shack where you can meet with the gang—a bigger and better Bargain Counter—larger and more complete stockrooms.

A streamlined Order Department that will get us back to our pre-war speed of **4 Hour Mail Order Shipments**—A special Export Department to expeditiously handle the orders from our good friends in other parts of the world—

And many more new features—all designed to better enable us to give the friendly service and superior value that have made Harrison's the Ham Headquarters—Since 1925!

Business going on as (or even better than) usual during alterations. Drop in now and you'll pick up some exceptional bargains during our E-X-P-A-N-S-I-O-N SALE!

73

Bil Harrison, W2AVA

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SIGNAL CORPS EQUIPMENT

Here are some exceptional bargains in AAF gear that are easily adapted to efficient Ham use.

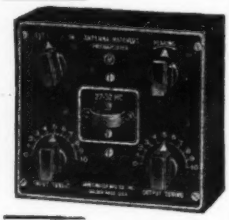
There are lots of these used units around, but we believe we have been discriminating enough to be able to offer you the very best ones! Carefully reconditioned, checked, and crated to come to you in almost new condition—yet our prices are no higher! Order yours from Harrison—in a hurry—and you'll be happy.

SCR-522 VHF Transmitter-Receiver. Complete with 17 tubes, control box, dynamotor, crystals, etc....$39.95
SCR-274-N. THREE Receivers, TWO Transmitters, controls, antenna unit, dynamotors, 29 tubes, etc...$39.00
BC-375-E Transmitters. Complete with tubes, tuning units, antenna tuner, dynamotor, etc. $35.00
BC-348 Receivers. Complete with tubes, crystal filter, dynamotor, etc., less speaker $49.50
BC-221 Frequency Standard. Complete with original crystal and calibration chart, and tubes, in cabinet. $39.50

HAMMARLUND FS-135-C

Crystal controlled frequency standard. Easily connected—zero beat with WWV—and your receiver is an FB Freq. Meter! Complete unit with crystal, tube, and simple instructions **$14.25**

MILLEN R-9'ER



Hop up your receiver with this new antenna matching preamplifier! 2T-32 **$24.75**

48-55 Mc plug-in inductor $3.15
13-15 Mc plug-in inductor $3.15
6AK5 Tube $3.30

RG-8/U COAXIAL CABLE

52 ohm. FB for feeding beams, etc. Handle a KW. New, perfect cables 110 feet long with two PL-259 coaxial plugs. Total list price is $39.28. HSS Special! **$4.98**

DYNAMOTOR

Delivers 500 volts at 160 MA from 6 or 12 DC. From PE-103 Pack. Brand new! **$5.75**

KW MODULATION TRANSFORMER

Here's the one they're all talking about! RCA broadcast quality. 550 Watt conservative audio rating. 1 to 1 ratio will match most any tubes. Screen winding. Safety flash-over gaps. 38¼ lbs. **$14.75**

New! SONAR VFX-680

NBFM, ECO, "Rubber Xtal," Exciter Unit. **$87.45**
Harrison Has It!

1947 MEISSNER

Signal Shifter. Complete for all band operation **$120**

SERVICEMEN HAMS!

Earn money for that new rig by selling Intercommunication Systems. Talk-A-Phone and Bogen in stock!

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we are now entering orders for earliest delivery. Literature upon request.

MEISSNER RECEIVER KIT

Build your own 6 tube AC-DC two band BC receiver with this famous 10-1199 kit! Complete with speaker and antenna, less only tubes and cabinet. **$19.75**

Get ready for SUMMER FUN ON 2

Abbott TR-4B, Transmitter-Receiver. Complete with tubes—$56.78. Abbott 110 V AC, power pack—$22.50. EL 6 Volt Vibrator, pack—$14.97. EL Combination 110, AC/6 V DC input. Delivers 300 Volts DC at 100 Ma, 6.3 at 4.75 A—$27.00. Abbott 5 element high gain beam. All aluminum. Complete, ready for easy assembly —$14.10

MECK T-60 TRANSMITTER

Compact! 15" x 11" x 9" metal cabinet contains complete 60 watt input phone-CW Xmitter. 110 Volt AC. With all tubes and 10 meter coils, less only **$150** microphone and crystal .....

COMMUNICATION RECEIVERS, AMATEUR TRANSMITTERS, TEST EQUIPMENT—All Makes, All Models. Harrison has the biggest and most complete stock! Lowest Prices! Top Trade-in allowances!

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U.S. SIGNAL CORPS SHORT WAVE XMTRS. **5 Meter** (72.2 Mc) **XMTR and Tube Only** ONLY **$3.49** Less mike, Batteries and Antenna

One 1½ volt dry cell and 67½ volts of B operates it. Just attach di-pole, key or mike, connect the batteries and it's ready to use. Signal Corps spec wired with silvered wire, mica condensers, and precision resistors. Highly stable circuit with Lo-Loss silvered inductance. (Adjustable padder.) Schematic supplied. Converts to walkie-talkie and Ham bands. Weighs less than a pound. Shipped by express only. No C.O.D.'s. No Parcel Post. A sacrifice at only $3.49. Postal or express money order or certified check.

NEWARK SURPLUS MATERIALS CO.

324 Plane St., Dept. C, Newark 2, N.J.

SEND STAMP FOR GIANT CATALOG!

AMPLIFIER

For Call System or Phono. Amplifier

$2.95

• Complete with tubes • Compact—wired
• Ready to Operate • Uses 35Z5—50L6.

N. J. INDUSTRIAL CO.

309 ELM ST. NEWARK 5, N. J.

Coast-to-coast television will become a reality before the end of 1948, say Bell Telephone engineers, who report that nearly three-quarters of their transcontinental co-axial cable is "under ground."

TECHNOTES

(Continued from page 56)

. . . . GE LB530

If the battery charges too slowly or refuses to take a charge, check the control switch for high-resistance contacts in the a.c. or charge positions. Poor contacts here will hamper charging action. Replace the switch or clean and tighten its contacts.

OTTO WOOLLEY
Colo. Springs, Colo.

. . . . STROMBERG 65 and 66

In these and other Stromberg-Carlson models using wired remote-tuning systems, the armature of the on-off relay on the main chassis sometimes sticks because of residual magnetism in the cores. To restore operation, remove the coils and file down the cores so that there will be a 1/32-to 1/16-inch air gap between them and the armature, which will then rest on the insulating washers. File the faces at an angle so that they will be parallel to the armature. This will not shorten the core too much.

WILLIAM FORD, JR.,
Chicago, Illinois

(If troubled with residual magnetism, why not demagnetize the core in an a.c. field?—*Editor*)

. . . . G.E. MODEL TC-3 TUBE TESTER

In the January 1947 issue of RADIO-CRAFT there was a Technote regarding the tube short indications given on the Model TC-3 and TC-3P tube testers. This is a situation which has arisen with the development of newer tubes having a high plate-to-cathode capacity.

The model TC-3 tube checker was originally engineered for high sensitivity on the four short test positions. Because of this high sensitivity, tubes with very slight base or interelectrode leakage will, at times, indicate a direct "shorted" condition. For all practical purposes, however, these same tubes will perform satisfactorily in the average radio receiver.

If it is desired to reduce the sensitivity of the short test in the Model TC-3, the following modification may be made:

Withdraw the equipment from the case by removing the twelve nickel-plated screws from the edges of the panel. Solder a 1-megohm, ½-watt resistor directly across the tubular paper condenser which is wired to the test switch. The capacity of this condenser varies in different production models from .01 to .005 μf but it should be easily located since it is the only tubular condenser on the test switch. Replace the equipment in the case.

This modification will cause the "short" indicator to glow with a resistance of approximately 250,000 ohms or less present in tested tubes. Key positions and index settings will not be affected by this modification.

R. H. RUDOLPH,
General Electric Co.

SPEEDY A.C.-D.C. SERVICING

(Continued from page 28)

Leaky or noisy by-pass condensers can be found by moving them around while the set is operating. This may be best done with an orange stick or insulated rod. (A screw driver might slip off and cause a short.) Any condenser

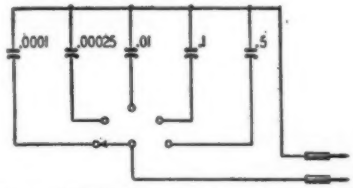

Fig. 3—Substitution box for r.f. capacities.

that causes the slightest noise should be replaced.

Checking the volume control

Volume control trouble is one of the easiest faults to find. Move the knob up and down. If the control is faulty, there will be a noisy burst from the speaker. Turn the knob slowly, from minimum to maximum position. Scratching noise, or points where the set cuts out completely, may be noticed.

If you think that the control is the cause of the set being completely dead, connect "hot" and center lugs. If the set begins to play when the control is shunted, you know that it is open. This test works for most circuits, but fails for some.

Quick resistor tests

Someone has said, "There is only one simple way of testing a resistor—with a multirange ohmmeter." Here is another quick, very effective, method of testing the small resistors in a set. The set is turned on and a station tuned in. The leads of a multimeter, turned to the highest d.c. voltage range, are put across the suspected resistor. The voltage selector switch is turned down the scale, stopping at each position to note

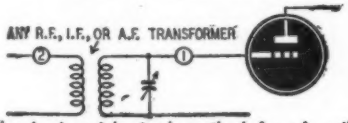

Fig. 4—A quick check method for r.f. coils.

if there is any improvement in the set's performance. Of course the meter is watched to see that it is not driven off scale.

This test is the same as the substitution method. The various resistors of the multimeter are shunted across the resistor in question.

Open or shorted coils

Much time is used up checking r.f., a.f., and i.f. coils for continuity or winding resistance with an ohmmeter.

Here is a faster way of finding the trouble, one that actually shows the working condition of the coil instantly. Your finger serves as the test instrument. Be very careful not to touch more than one part of the circuit at a time. It is especially important to watch the other hand. It should not contact the chassis or any other part of the set. There is danger of shock. Touch the moistened finger to the grid of the tube following the coil under test. If the circuit is working properly between that point and the speaker, a loud, clear click will be heard. Next touch the primary terminal of the coil, the one connected to the plate of the preceding tube. A loud, clear click here indicates that the coil is working perfectly. Refer to Fig. 4 for the points to be touched.

In a.c.-d.c. midgets with dynamic speakers an open field coil often causes trouble. It is an easy matter to check the field strength. Hold a small screw driver in front of the cone, within about ¼ inch of the pole piece. If the screw driver is strongly attracted, the field coil is O.K.

One of the best ways to check a magnetic speaker is to have a small test speaker with long flexible leads mounted on the service bench. If small alligator clips are provided on the leads, the test speaker can be connected quickly in parallel with the one in the set. The set speaker cone can be held in tightly with the hand to prevent it from operating.

Common sense is the greatest aid to speedy servicing. Note symptoms and make first the tests which seem most likely to apply in the particular case.

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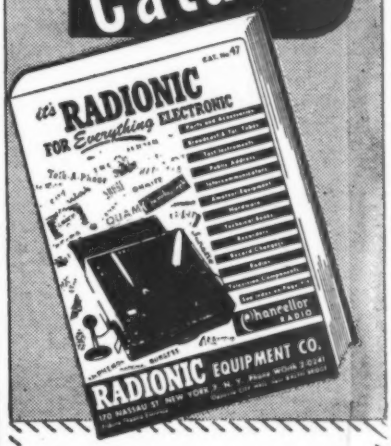

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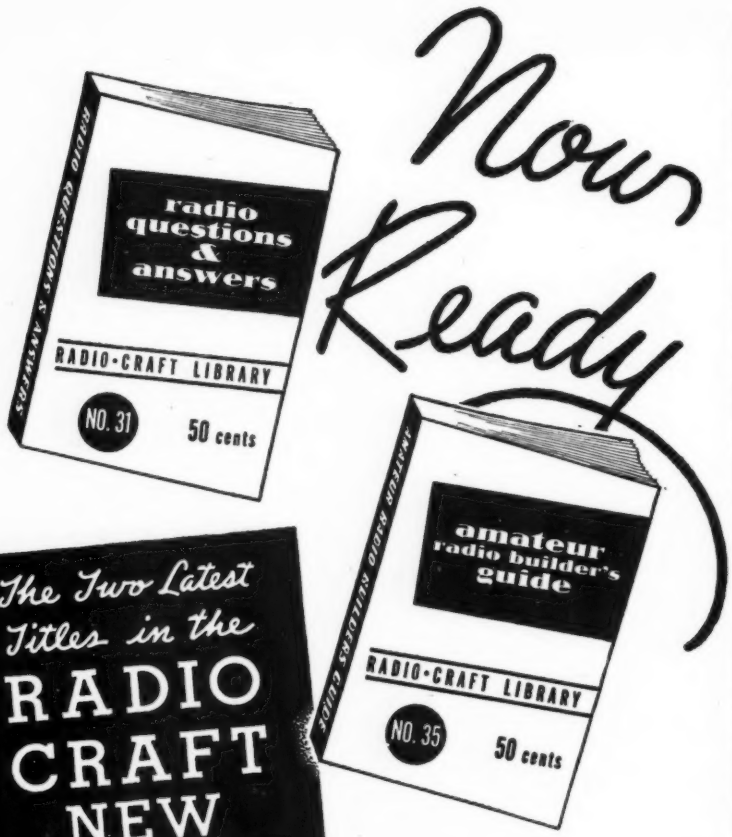

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TELEVISION FOR TODAY

(Continued from page 69)

eration is limited. In a sense, the relatively poor regulation is advantageous, since it decreases the possibility of fatal injury to anyone accidentally touching the high-voltage terminals. For the serviceman, it is suggested that the following be committed to memory:

All high voltages must be turned off before any work is done on a television receiver. High-voltage terminals do not have to be touched to prove fatal; the voltage can span small distances. The only safe method of repairing a high-voltage unit is by substituting components or by resistance measurements.

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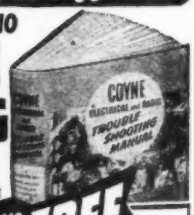

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(Continued from page 35)

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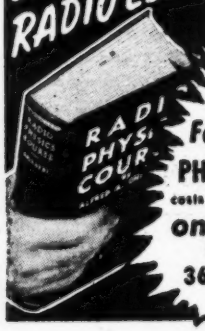

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MONEY-BACK GUARANTEE

MULTI-STATION INTERCOMS

(Continued from page 33)

cable with the required number of conductors will do just as well. Twisting of the wires is unnecessary and shielding is an added expense that yields no advantage. (Other sound men may dispute that statement.—*Editor)*

For outdoors, the cloth-covered cable is not usable. Ideally, weatherproofed wire such as that used by the telephone company would be best, but, so far, the author has never seen any multiwire cable of that type. Practically the only type available and feasible is rubber-covered. Use the best grade, in which each conductor is covered with color-coded rubber, with a heavy over-all live-rubber sheath. If there is a shield beneath the sheath, use it as the common lead, but if possible, save money by getting unshielded cable with the proper number of conductors.

Cable should be kept off the ground as much as possible, since soil is chemically bad for rubber. It can be suspended between trees, but, if there is any tendency for the tree to sway in the wind, be sure to leave plenty of slack. If it can be fastened along the top of a high fence, that is ideal. Outdoor installation is tedious, and hazardous if not done right, so run cable as much as possible indoors.

Indoors, running the cable is just a matter of keeping it out of sight and possibility of damage as much as possible. If feasible, running it along mouldings is better than on baseboards. Vacuum cleaners, carpet sweepers, and other such instruments are lethal to cable if they tangle with it.

Methods of going through doors and windows are varied. A hole right through the window frame or doorjamb in an inconspicuous spot will often suffice. One good tip is to find the telephone cable, if possible, and follow it. Usually, if the telephone cable is at all large, the holes through which it travels are large enough to allow the intercom cable to be squeezed through too. If it is necessary to enlarge any of these holes slightly, use the utmost care, as most telephone companies are singularly unfriendly toward anyone who damages their cable.

After the cable has been laid, it must be connected to the junction boxes. Make a tabulation of the code colors and assign each a number. Connect each color to the correspondingly numbered box terminal. If the same type of cable is used to connect each station to the junction box, the color code will be complete for the whole installation.

Servicing intercoms is very easy. If a station fails to operate, the first thing

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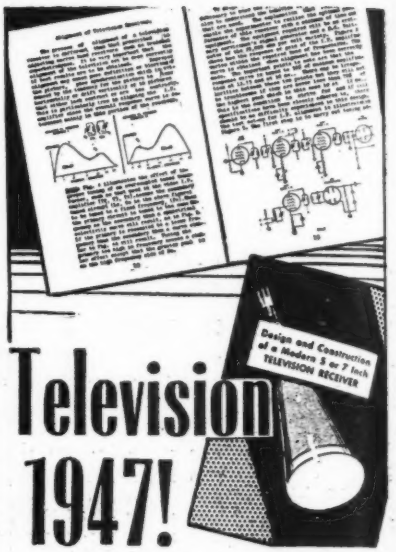

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is to check whether the cable has been damaged, or the amplifier is bad. If the tubes light, take a station from another location and substitute it for the suspected one. If it fails to work, the cable must be gone over.

To check the cable electrically, remove the plugs of all stations from their junction boxes, and check terminals with an ohmmeter for shorts. To find opens quickly, short any two conductors at one location and see if an ohmmeter across the corresponding terminals of another station shows the short. Repeat this until the trouble is located.

The amplifiers are much less complicated than ordinary radios, and servicing them is therefore a simpler problem. Since there are very few components in any of them, the most trouble will be found in tubes and filter condensers. Always check the outgoing cable connections in each amplifier unit. If possible, a miniature cable clamp should have been used in assembling them to keep the cable and a.c. cord from being pulled.

A final touch, which will add a professional air and inspire trust, is the preparation of a small instruction manual. Two pages or so will suffice. Manipulation of the controls should be explained clearly and inclusion of information about the privacy and versatility of the system is good advertising. If the person who makes and installs the system does not intend to service it, a paragraph or two headed "For the Serviceman" will help him understand the units. A schematic of the amplifiers and remotes should always be included, together with cabling information.

Speaking of advertising, it is always a good idea to install a cable with enough conductors to accommodate the maximum number of stations allowable with a particular system, even though that number may not be in use. Invariably, purchasers are highly pleased with intercoms after they become accustomed to using them, and often they decide to add more stations. If the cable is already large enough, it need only be tapped or extended to add units, but if not, entirely new cable will be needed.

CORRECTION

On the Question Box page of the February 1947 issue the values of C1, C2 and C3, in the intruder alarm, were not shown. C1 is a 1-μf paper condenser with a working voltage of at least 450. C2 and C3 are identical units connected in a voltage dividing network. Each is made by connecting a 500-μμf mica condenser in parallel with a 500-μμf variable trimmer. A 2-gang variable of large capacity might be used for each of these.

We thank Mr. Lewis P. Lane, of Ojia, Calif., for calling our attention to the omitted values.

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5Y3GT	40	37	XXL	50	40
5Y4GT	45	37	12A8GT	60	49
6A7	62	50	12J7GT	50	42
6A8GT	62	44	12Q7GT	53	45
6AB7	69	65	12SA7GT	50	39
6AC7	69	65	12SQ7GT	50	39
6C6	50	42	12SK7GT	50	40
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6K6GT	59	39	27	42	38
6K7	60	50	35L6GT	60	50
6K7GT	60	44	35Z3	65	60
6K8	60	54	35Z5GT	65	42
6L5G	65	40	43	90	60
6SA7GT	50	45	45	66	50
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6SJ7	50	49	50L6GT	65	50
6SK7	55	48	56	51	45
6SK7GT	60	38	75	67	44
6SL7GT	60	52	77	45	39
6SQ7	50	45	80	40	38
6SQ7GT	50	45	84/6Z4	58	45
6U7G	60	48	117Z3	85	60
6V6GT	83	50	12AT6	75	45
6X5GT	55	45	12BA6	75	45
7A4	69	40	12BE6	75	45
7B6	50	40	50B5	54	42
			32L7GT	90	80

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CODE OSCILLATOR

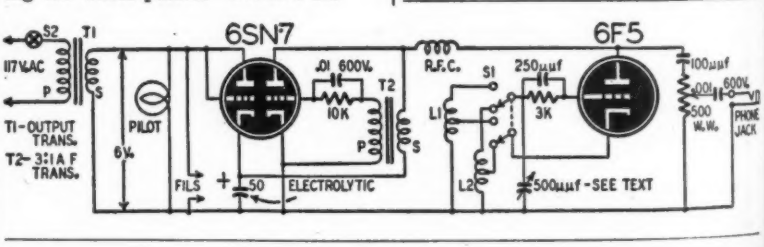
Upon reading about Mr. Gnessin's very unique code practice oscillator in the June, 1943, issue of RADIO-CRAFT, I was determined to discover if such a hookup would work on the radio frequencies as well as the audio. The result of this experimenting is a midget signal generator for i.f. and r.f., covering from approximately 450 to 1800 kc.

Many diagrams of signal generators were studied before any attempt was made to make this one. A small yet efficient oscillator was desired. The smaller signal generators were all a.c.-d.c., and this type of unit was undesirable as there is always the possibility of shorting out the line in aligning another a.c.-d.c. set. Other designs used a bulky power transformer to avoid this setup. This again was undesirable because of the space a power transformer would require. The only way out seemed to be by the use of 6 volts on the plates of the various tubes.

First, an audio oscillator similar to the one in RADIO-CRAFT was constructed. A 6SN7 was used in this part of the circuit. After this section was completed and tested, construction of the r.f. end was started. The r.f. oscillator consists of a 6F5 triode, hooked up similarly to an electron-coupled oscillator.

The set is tuned by means of a midget condenser with its two sections connected in parallel. This was done to give greater frequency range. A double-pole double-throw switch changes the oscillator from high to low frequency. The 500-ohm potentiometer gives adequate attenuation. A phone jack provides for the feeding of the output to a shielded greater frequency range. A double-pole cable. The i.f. coil has 150 turns of No. 30 enamel wire and the broadcast coil 90 turns of No. 28 enamel. Both are close-wound on 1½-inch forms and tapped one-third the distance from the bottom.

The entire unit was built into a cigar box measuring 5½ x 9 x 2½. The a.f. part was put in the bottom of the box, leaving the top for the r.f. section. By careful planning, the components can easily be made to fit in a cigar box of average size. This signal generator has been used for quite some time and has never given the least bit of trouble during the whole period.—*Bernd Falk*



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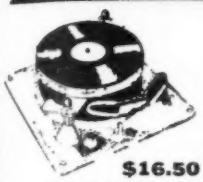

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A SMALL RECORDING STUDIO

(Continued from page 31)

boosted on the recording and de-emphasized when the disc is played back. The de-emphasis reduces the scratch, resulting in a quieter recording.

Volume level indicators

With a crystal cutter of the type described, the signal voltage required in Fig. 2-a is 50 r.m.s. volts and in Fig. 2-b, 150 r.m.s. volts. This voltage is read with an a.c. voltmeter across the amplifier output. This voltmeter should have a flat frequency characteristic over the audio range and should not materially load the output circuit. If the meter is connected across a 600-ohm line, as in Fig. 2-b, it may be a commercial db or v.u. meter, calibrated in decibels or volume units, respectively. (Zero db equals 600 milli-watts from a 600-ohm circuit.) The v.u. meter is calibrated in volume units and is carefully designed to follow the average audio level. It is also calibrated in some cases, in db.

In the interest of economy, an output level indicator may be made by connecting a d.c. milliammeter and a rectifier. The rectifier may be a copper-oxide or a vacuum-tube diode, or a 1N34 germanium crystal diode may be used. To make the meter follow the average level, a capacitor may be connected across the rectifier load, or a sensitive meter used

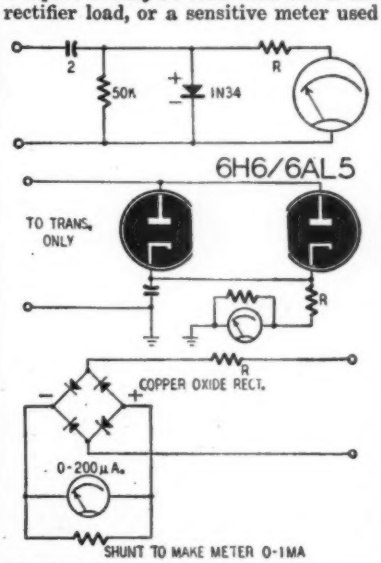

Fig. 3—Output meter rectifiers, three types.

with a heavy shunt, or both. Fig. 3 shows several output meter circuits. Figs. 2 and 4 show their proper con-

(Continued on page 84)

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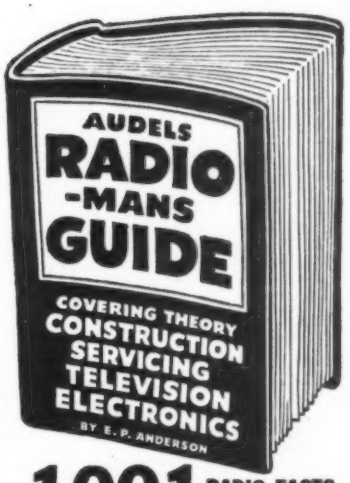

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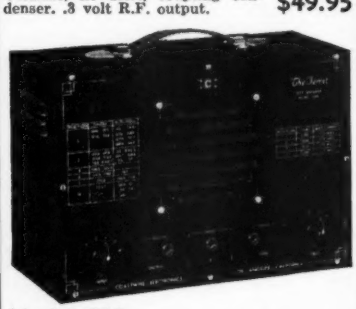

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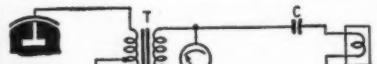
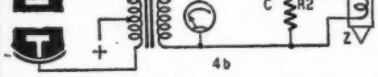
nection in the circuit. The resistor R should be great enough to prevent damage to the 1-ma meters. For Fig. 2-a, 150,000 ohms and, for 2-b, 50,000 ohms, would be a safe first approximation. Transformers used in coupling the amplifier to a cutter or speaker must be of the highest quality in order to reduce distortion to a minimum and to provide a wide frequency response. This is particularly true when the output tubes are beam tetrodes with or without negative feedback. A high order of negative feedback cannot be applied around a poorly designed transformer.





CUTTER IMPEDANCE	8Ω	500Ω
VALUE C MOD. CONSTANT VELOCITY	40μf	.5μf (10,000 cps)
VALUE C CONSTANT AMPLITUDE	2μf	2μf (10,000 cps)

4c

Fig. 4—Compensating network considerations.

One of the photos shows a collection of high-quality transformers capable of the highest fidelity.

Compensating networks

When the cutter is of the magnetic type, the connection may be as seen in Fig. 4.

A magnetic or dynamic cutter has a natural constant-velocity characteristic—the stylus amplitude varies inversely with frequency. If the output is adjusted for the correct stylus amplitude at 1,000 cycles, the resultant amplitude at 50 c.p.s. would be so great as to cut into the next groove, and so it is conventional to limit the amplitude of the stylus motion. This is done by connecting a network between the amplifier and the magnetic cutter to impart a constant-amplitude characteristic below a certain turnover frequency. This frequency is usually near 500 c.p.s.

The network consists, in its simplest form, of a series-connected capacitor as shown in Fig. 4-a. The impedance of the transformer is chosen to match the impedance of the cutter. With C connected as shown, its reactance at a very high frequency will be so low as to constitute, effectively, a short circuit and cease to exist electrically. At some frequency, its reactance will increase to a point

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where it is equal to the impedance of the cutter. At this point the voltage across the cutter will be reduced by a factor of 2 (6 db). As the frequency decreases, less and less voltage is impressed across the cutter and more and more across the capacitor C.

The slope of this decrease in cutter voltage with frequency will be approximately 6 db per octave, which is correct to impart a constant-amplitude characteristic to the cutter stylus.

The value of C determines the point at which the transition from constant velocity to constant amplitude takes place. If a very high frequency is chosen for the turnover point—10,000 c.p.s., for example—the cutter becomes a constant-amplitude device below that frequency and will record in the same manner as a crystal. The value of C will be found in the table in Fig. 4-c.

It is possible to vary the effect of this series condenser by shunting it with a resistance of the proper value. For instance, the value of R1 may be selected so that in the circuit in Fig. 4-b, the cutter becomes a constant amplitude device down to some predetermined low frequency, and then becomes constant-velocity again. This would result in a bass-boost cutting characteristic which would be effective if a record is to be played on a turntable with appreciable rumble, as the playback amplifier can be adjusted to reduce its low-frequency response and this would in turn reduce the playback turntable rumble.

If the cutter has serious peaks in its response curve, it might be feasible to reduce this effect by shunting the cutter with a resistor such as R2 in Fig. 4-b. This would have the effect of damping the peaks in the cutter's response and also reducing the effects of these changes being reflected back into the network and the output tubes. Of course, the impedance of the cutter for calculating C is the parallel combination of R2 and the cutter. The impedance of the cutter at some frequency is usually supplied by the manufacturer.

In low-impedance output circuits, it may be necessary to use electrolytic capacitors for *C*, due to the impractical size of the large values. There is no d.c. polarization voltage, so two electrolytic condensers of twice the necessary capacity can be connected in series opposing; that is, the plus terminal of one connected to the plus terminal of the other, and the two negative terminals used to connect the resultant capacitor in the circuit.

Power limitations

It is worth while noting that too much bass boost, with a magnetic cutter, may result in the driven reed hitting the pole pieces. Also, the travel on a magnetic cutter becomes nonlinear with extreme stylus motion. It is therefore unwise to exceed the manufacturer's rated input level.

The crystal cutter can be ruined by the application of too high a voltage. If there is danger of the application of too high voltage to a crystal, a protec-

(Continued on page 89)

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This type of interference is recognized by every good service man as the signal put out by the nearest airways beacon transmitter leaking through the mixer stage into the i.f. amplifier, which is probably peaked on the beacon's frequency.

One way to get rid of it, the oldest and easiest way when it works, is to detune the i.f. stages from the original frequency and peak them at least ten kilocycles away from the interfering signal. That's fine if the oscillator circuit of the set has a low-frequency padder that will allow for re-tracking. But remember that it is sometimes necessary to remove the i.f. much farther than ten kilocycles, to get rid of the unwanted interference. Many cheap sets, however, are designed to track with a specially cut oscillator tuning condenser section at the i.f. recommended by the manufacturer. Throwing the i.f. off this frequency, therefore, causes the set to function poorly or—in many cases—not at all.

The most logical and most efficient method of eliminating this interference is to insert a wave trap in the antenna circuit of the receiver or in the grid circuit of the mixer stage. The old way of doing this was to simply disconnect the aerial lead where it joined the set antenna post and connect a coil and condenser in a parallel-tuned circuit in series with the antenna and the set.

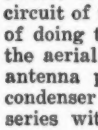

Fig. 1

(Fig. 1) This left exposed leads—including the antenna coil which was generally unshielded — which picked up sufficient signal to make the hookup practically worthless. On the other hand there is generally little room left in the average set to install a wave trap on the chassis where the leads may be short and the installation shielded sufficiently to get maximum results.

This calls for some ingenuity on the part of the radio man. Many small sets have the antenna coil mounted on top of the chassis near one corner with quite a bit of space above the coil and the top of the cabinet. In these cases inductive coupling may be used without the necessity of even making an electrical connection. Simple wave traps are constructed of one coil of an old i.f. transformer with a suitable trimmer con-

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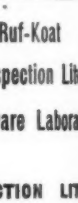

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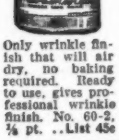

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denser across it and mounted as close to the grid end of the coil as possible and cemented in place with coil cement freely applied. (Fig. 2). Being duo-lateral wound, they take up little space and will fit the end of most solenoid-wound antenna coils. The i.f. coil should be from an old transformer of the same frequency as that of the set in which it is used.

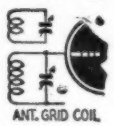


Fig. 2

If the antenna coil of your set is in an inaccessible place or is a duo-lateral coil wound on a wooden core, it may be impossible to couple the wave trap inductively to it. The next best bet is to wire the wave trap in series with the grid circuit of the antenna stage. Break the connection between the grid coil and condenser and the grid prong of the mixer tube or the r.f. tube (whichever is the antenna stage in the set) and connect the wave trap in series, as shown in Fig. 3. If fairly heavy tinned copper wire is used and the leads kept short and direct, no trouble should be experienced with extra wiring capacity in the circuit.

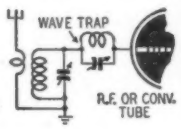


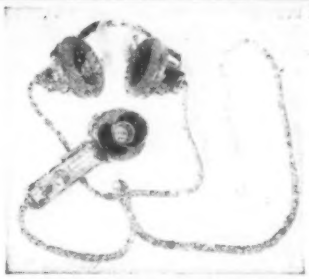
Fig. 3

To adjust the wave trap for maximum efficiency, connect a standard signal generator to the antenna and ground connections of the set, set it to the frequency of the interfering signal, which will usually be the intermediate frequency of the set. Adjust the output of the signal generator to a value high enough to be heard clearly in the set speaker or cause a good deflection on an output meter across the secondary of the speaker output transformer. Adjust the trimmer condenser on the wave trap until a MINIMUM of sound is heard in the speaker or a MINIMUM deflection is obtained on the meter.

This adjustment should be fairly critical or sharp and should reduce the signal from the generator to a very low value, sometimes causing it to disappear at the original signal level from the generator. In this case turn up the generator level control until a reading is obtained and continue to adjust for MINIMUM response.

To get sufficient rejection of the unwanted signal and to trap a frequency band only as wide as the unwanted signal, the wave trap circuit must have a *high Q*. The trimmer condenser should have good quality mica and good insulation at its terminals. Also the ratio of capacity of the trimmer to the inductance of the coil must be high enough to get good circulating currents in the trap circuit at the frequency of the unwanted signal. The usual i.f. coil has a good enough set of characteristics to pass the requirements for the coil but the Q of the trap circuit can generally be raised by removing a few turns from it and using a 15-75 μμf condenser to tune it, thus raising the Q of the entire trap circuit.

(Continued on page 96)



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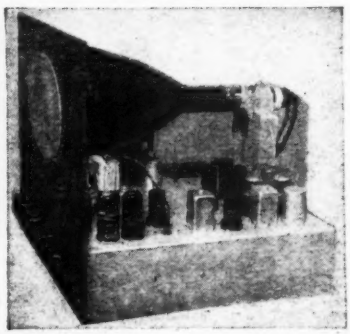

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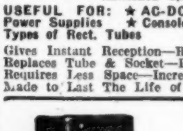

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HOME-BUILT SOUND EFFECTS

(Continued from page 27)

a saw. Any noisy tool will record well, and the sound can be bigger than life if amplified.

To turn on the lights, use an electric switch. Taking the telephone receiver

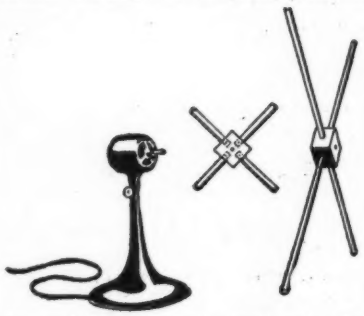

Fig. 6—A fan motor and dowels make wind.

off the hook and replacing it is very convincing if done close to the mike. To strike a match, a special trick increases the effect. Strike the match about 4 inches from the mike, then quickly move it very close to catch the flaming noise as the head burns.

Making our noises work

For the radio workshop or the "home-broadcaster," what to do with the various noises he has recorded presents no problem. Others may be embarrassed with a wealth of canned sounds. As a

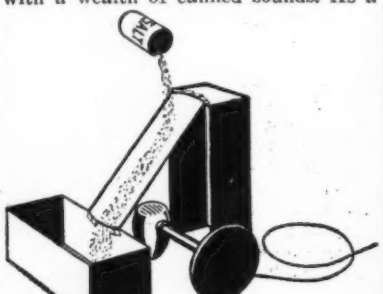

Fig. 7—Rainmaking is easy with this machine.

suggestion, amateur plays may be improved by properly used sound, amplified or recorded. The modern "radio script" type of play can be immensely heightened in interest if genuine radio-type sound effects are used. Enthusiastic sound-effects recorders have even used the sounds as a subject for an evening's entertainment, making a guessing game with prizes for participants naming the greatest number of effects correctly. It is surprising indeed how many sounds may be misinterpreted if the listener's mind is not directed by the contextual material.

Airlines are testing a "block signal" method which will light a red or green light on the pilot's instrument board, telling him whether or not he may enter the next "section" of the airway.

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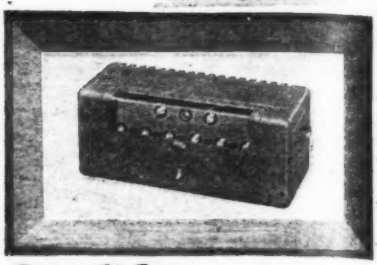

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SMALL RECORDING STUDIO

(Continued from page 85)

tive circuit should be provided. Neon bulbs connected in series can be placed across the crystal so that, in the presence of too much voltage, the bulbs will fire and their resultant low resistance will protect the crystal cutter. The small ¼-watt neon bulbs have a firing voltage of approximately 70 volts. It is essential that the bulbs do not fire during the application of normal cutter driving voltage, or distortion will result.

In the final analysis, what is really expected of a cutter is a recording which, when played back, sounds as like the original material as possible. Each recording setup requires individual attention to obtain the best results of which it is capable. Each set of requirements and conditions is different; it rests on the user to take maximum advantage of the equipment he has so that he may produce good recordings.

VIBRATOR AMPLIFIER

This six-volt battery-powered amplifier is very compact and is easily constructed on a 7¼x5¼x2¼-inch chassis.

It uses a pair of push-pull 6V6 beam-power pentodes driven by a cascade connected 6SC7. A push-to-talk switch on the microphone reduces the drain on the storage battery when the amplifier is on stand-by operation.

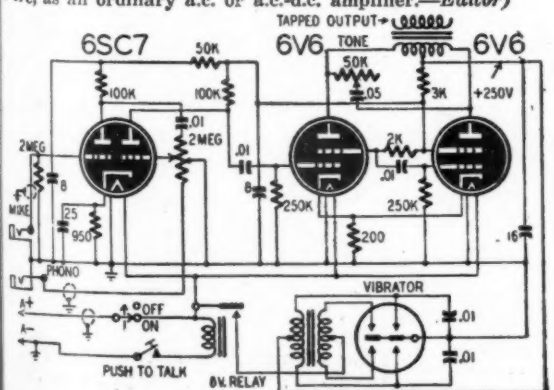
The 6SC7 is connected in a standard cascade circuit with a fader-mixer in the grid circuit of the second half of the tube. This permits gradual switching from microphone to phono pickup.

A novel phase inverter is used. A 2000-ohm loading resistor is inserted in the screen grid lead to one of the 6V6's. This grid is capacity-coupled to the control grid of the other 6V6. With 250 volts on the screen grids of Class AB1 6V6's, the screen current for each tube swings from 2.5 ma at no signal to 6.5 ma at maximum signal. This variation in screen current is converted to variable voltage drop across the 2000-ohm resistor. The grid of the second 6V6 gets its excitation from the variable screen voltage. This phase inversion system makes it possible to take full advantage of the 6SC7's amplification.

The power supply uses a synchronous vibrator feeding into a resistance-capacity filter. A push-to-talk switch closes the low-voltage circuit through the coils of a relay, made from an old vibrator.

—Edgar Dunn, Johannesburg, South Africa

(This amplifier is worth trying without the vibrator feature, as an ordinary a.c. or a.c.-d.c. amplifier.—*Editor*)



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Kit of parts and plans for complete operation **$12.00**

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Extremely convenient test oscillator for all radio servicing; alignment • Small as a pen • Self powered • Range from 700 cycles audio to over 600 megacycles u.h.f. • Output from zero to 125 v. • Low in cost • Used by Signal Corps • Write for information.

GENERAL TEST EQUIPMENT
38 Argyle Ave. — Buffalo 9, N. Y.

EASY-TO-BUILD OSCILLOSCOPE

(Continued from page 24)

to external sweep and applying a sinusoidal signal to the horizontal binding posts on the front panel and another voltage of different frequency to the vertical amplifier, various patterns called *Lissajou figures* will be obtained. These figures are helpful for frequency calibration or comparison.

To obtain a trapezoidal pattern for determining the percentage of modulation of an amateur transmitter, the connections to the rear panel should be made as shown in Fig. 10. Fig. 11 shows

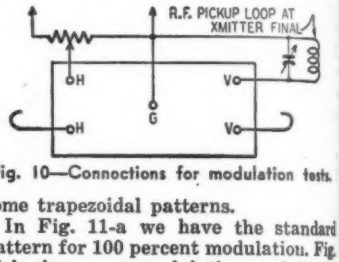

Fig. 10—Connections for modulation tests.

some trapezoidal patterns.

In Fig. 11-a we have the standard pattern for 100 percent modulation. Fig. 11-b shows overmodulation and 11-c a condition of less than 100 percent modulation. Patterns similar to 11-d are due to phase shift in the speech amplifier.

The value of an oscilloscope in servicing receivers was shown fully in two articles *(The Scope—A Repair Tool.* January and March RADIO-CRAFT).

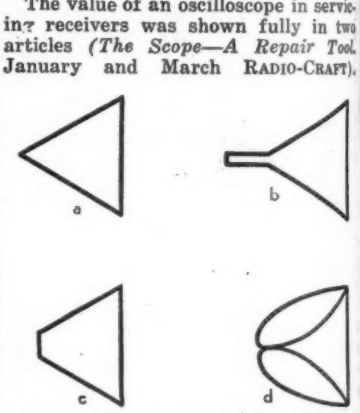

Fig. 11—A few more common Lissajou figures.

After having built and become familiar with the operation of a scope and its capabilities as an instrument, anyone having one will discover new uses for it daily.

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PHONO PLAYER KITS, Table Model, dual tube amp. five inch speaker, light weight crystal pickup, attractive two tone cabinet and quiet rim drive motor. Model RCP4, complete $15.95
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Tubes are supplied with all the above kits.

AMPLIFIER KITS—3 tube RC3, $3.80; 2 tube RC2, $2.60; 1 tube RC1, $2.10; phono oscillator kit RC1W, $2.90. Tubes extra.
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Our warehouses are filled with thousands of choice Government Surplus Radio Items. Lot of them we do not have in sufficient quantity to advertise nationally and the cost of inventorying, itemizing, corresponding, etc., would only increase their cost to you; therefore we make this offer. If you wish to mention a few items you desire, we will endeavor to include them in this assortment. State whether you wish "Ham" or Commercial assortment.

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Radio Thirty-Five Years Ago

In Gernsback Publications

HUGO GERNSBACK
Founder

Modern Electrics	1908
Electrical Experimenter	1913
Radio News	1919
Science & Invention	1920
Radio-Craft	1929
Short-Wave Craft	1930
Wireless Association of America	1908

Some of the larger libraries in the country still have copies of ELECTRICAL EXPERIMENTER on file for interested readers.
Interesting Radio Articles in the May, 1913 issue of the ELECTRICAL EXPERIMENTER.

A Treatise on Wireless Telegraphy, by *Hugo Gernsback.*

The Quenched Spark Gap, by *H. Winfield Secor.*

Building Large Spark Coils, by *Hugo Gernsback.*

The Vacuum Detector, by *H. Winfield Secor.*

How to Make a Loud-Speaking Telephone.

The Tuft's College Wireless Society.

35-mile Transmission with Half-Inch Spark Coil.

400 MILLION U.S. RADIOS?

(Continued from page 17)

during the next decade we can confidently look forward to a future in which there will be between 400 and 500 million radio sets of various types in this country. Even this will not be final saturation; because by the end of 10 years several new types of radio receivers—for instance television combined with radio sound sets, and many others—will have made their appearance.

Add to that replacements of obsolete radios and even the most pessimistic radio man must admit that saturation in this country is—for practical purposes—distant and unreal.

Six American railroads were using either carrier or high-frequency radio by the middle of the past summer. Most frequent use has been in freight service.

TELEVISION "ORGAN"

Suggested by Grego Banahuck, New York City

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$9.95 F.O.B. DETROIT

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Brand new army mine detectors; portable, will detect metallic and non-metallic objects; very sensitive; using 955 tube in detecting head; two tube amplifier using two IN5GT; headset; or microphone. Also 150 micro meter; power supply, 3-45V, one 6-V or two 3-V batteries. Complete with instrument less batteries. Packed in original cases. Shipping weight 108 lbs.

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8 mfd 500 volts 45c
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3" Square AC Milliammeter 0-1000 mils $1.95

BRAND NEW 6-TUBE SIG. CORPS RECVRS BC-453-B series. **SEASON'S BEST BUY!** Tubes alone worth total cost! All-Aluminum Aircraft receivers, 5"x8"x12½". Weight 6½ lbs. Black wrinkle enamel finish. Tuning range: 3 to 6 Mc. Tubes: 3—12SK7, 12K8, 12SR7, and 12A6. Power required: 250V @ 50 Ma and 25.2V @ .45A for heaters (easily rewired for 12.6V @ .9A. Hi and Low impedance output). Voice, MCW and CW reception.

EACH SET COMPLETE WITH ALL TUBES IN SOCKETS, less dynamotor $5.95
Same as above, but tuning range: 6 to 9.1 Megacycles **$5.95**

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Complete kit includes all component parts, tubes, punched and drilled chassis and beautifully enameled panel. Easily assembled and wired.

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COMMUNICATIONS

AN INSTRUCTOR LOOKS AT RADIO-CRAFT

Dear Editor:

Why do I buy RADIO-CRAFT? It cannot be because it is "too darned technical" for my pocketbook knows that I prefer the technical magazines. Having been in the radio field as an engineer for well over forty years I would have no interest in a magazine that catered too much to the screwdriver and plier type of serviceman.

My interest in RADIO-CRAFT is solely that of a teacher interested in seeing how others attempt to inform, and to instruct, the mixed audience of RADIO-CRAFT. When some of the instructors "talk down" to their audience they are sloppy and careless, but most of them give us something very well worth reading, and prepare their material with great care.

Your policy seems sound when I think of where your magazine fits into the present picture. During the war I thought you were a bit short of proofreaders; and that you were compelled to fill space with articles that were thrown together without care, but as things return to normal you should be able to select material with more discrimination. In general, sketches thrown together with parts missing or not properly identified are very provoking, even when one has no intention of using the material; they must be still more annoying to those who would build what is imperfectly shown and described in the article.

RADIO-CRAFT does not go to extremes. It very obviously keeps the rank beginner in mind at times, but its policy indicates to me that it believes that the beginner wants to grow.

THOMAS J. MACKAVANAGH,
Washington, D. C.

MILD DEFENSE OF AMERICAN RECEIVERS

Dear Editor:

Stavride's letter from Greece in the January issue was very interesting. Distance and the outsider's viewpoint lends a novel, discerning and honest air to the criticisms. However, there is usually more than one side to any problem in this cockeyed world of ours.

1. What is meant by the "best" American prewar sets? Does Mr. Stavrides include $1,200 Scotts or $600 Philcos or $700 Spartons in his "best" category? I would very much like to hear a "good" European set with better frequency response than those receivers.

2. Degenerative feedback must not be regarded as a magic cure-all. How is a resistance-capacity loop or degeneration in a cathode leg to compensate for nonlinear phase-shift, audio frequency-modulation, transient and complex intermodulation distortion in audio systems? Real quality is obtained not by phony "bass boost" or high-frequency cut-off and phase shifting "tone-controls" but by using low-mu triodes in push-pull; video-circu't type low- and high-frequency peaking circuits; direct coupling; $100 to $200 loudspeakers, flat from 30 to 15,000 cycles; and $30 to $50 laboratory standard output transformers flat from 20 cycles to 20 kilocycles. Such circuits are really wide-band and high-fidelity, but cost money—real money—and cannot be attained with a dollar's worth of condensers and resistors.

3. American receivers must use higher intermediate frequencies of necessity. This reduces various cross-modulation, harmonic, and difference-frequency interference effects from other American communication bands. Lower i.f.'s might improve gain but are impractical in the United States.

4. Cost and psychological factors are as important here as in Greece. Labor and material difficulties—real or imaginary—present a serious problem to American design engineers. It's a sad aftermath of a still sadder war and is to a large extent inevitable.

TED POWELL,
Maspeth, New York

THE GUITAR WORKS WELL

Dear Editor:

I have had such good luck with the Electric Guitar I made from instructions in your (1946) *Radio Electronics Reference Annual* that I am enclosing a photo of the complete project.

"EL" GRIMSHAW,
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Anyone Can Build Our

NEW MODEL S-5C RADIO

Our model S-5C uses the universally accepted superheterodyne circuit containing the following tubes: 12SA7, 12SK7, 12SQ7, 50L6, 35Z5 and tunes from 550 Kc. to 1600 Kc. Model S-5C . . . complete kit less tubes. With Bakelite cabinet and brand new illustrated instruction sheet, showing simple, detailed, step-by-step diagrams.

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when used according to instructions sent with each radio! You can use it at home, in many offices, hotels, cabins, in bed, etc.—lots of fun—real entertainment!

Send Only $1.00 (cash, money order, check) and pay postman $2.99 plus delivery fees on arrival or send $3.99 for postpaid delivery. Complete as shown ready to play with self contained personal phone. For Gifts—children will love it—grown-ups too! An exceptional value—order yours and enjoy the many good radio programs coming! Don't be without your Pa-Kette Radio another day! (All foreign orders $5.00 U.S. cash.)

Pa-Kette Electric Co. Dept. RC-5 Kearney, Nebraska

$3.00 FOR CARTOON IDEAS

RADIO-CRAFT prints several radio cartoons every month. Readers are invited to contribute humorous radio ideas which can be used in cartoon form. It is not necessary that you draw a sketch, unless you wish.

IDEAS NOT WANTED:

No electrical or radio definitions wanted. Some of these were published in the past, but the subject is about exhausted.

Payment is made on publication.

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Wire so fine that 1,000 feet of it reeled on a spool is invisible to the naked eye is reported by the Westinghouse Lamp Division. The wire was ordered by the Bell Telephone Laboratories for a new amplifier tube.

CONSIGNMENT COMING?

Dear Editor:

We are expecting some of the radio tube manufacturers to begin consigning tube stocks to radio shops, as was the practice before the war.

This will be a direct blow to all the better radio shops throughout the country, who have had to purchase their tubes outright during the war, many of them at black-market prices. It will also greatly stimulate the backyard mechanic and the number of new shops opening up over the country. It will also increase the price of tubes and parts to us all, for the manufacturer and jobber will naturally lose money on many of these consignment accounts, which must be made good by those that are able to keep going.

It would be well for the shop owners to fight such a plan by any manufacturer or jobber and voice their objections to their respective jobbers.

We will not use a tube that is being distributed on the consignment plan, and we will not do business with a jobber who is consigning tubes, if there is one we can find who does not.

G. E. RENFROE,
Southern Radio Service,
Thomasville, Ga.

BRICKBATS AND BOUQUETS

Dear Editor:

I have read your magazine for many years, but gradually it is becoming worse and worse as far as the amateur radioman, experimenter or set builder is concerned. Its only interest is to the serviceman or technician. Therefore you are just *out* one more subscriber.

G. L. RUIZ,
(No address)

Dear Editor:

I have the following bouquets and brickbats for your magazine.

I find the Question Box, Radio Electronic Circuits, and Try This One! departments very interesting. I feel, however, that you publish too many audio amplifier circuits in this department. Very satisfactory amplifiers can be designed by the experimenter from readily available information (tube manuals, books, etc.).

JOSEPH E. STEMBEL,
Kentland, Indiana

(We have felt there is not enough available material on sound and amplifiers. What do other readers think?—*Editor)*

Dear Editor:

I think your paper is swell but let's have a little more on how to build radio equipment and a little less on the subject of commercial and war radio equipment and the like. Thanks.

PETER MERRICK,
Hollyburn, B. C.

WIRELESS PHONO OSCILLATOR

Transmits recordings from phono pickup or voice from mike to radio without use of wires up to 500 ft. Neatly designed.

Complete kit, less tubes $3.49
Above kit assembled and tested 4.49
Tubes for above kit (12SA7, 35Z5) 1.49

IMMEDIATE DELIVERY

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TELEVISION KIT...A HIGH QUALITY TELEVISION RECEIVER

ready for Easy, Rapid Assembly

ENGINEERED BY TELEVISION SPECIALISTS

Easy-to-Assemble: No knowledge of television required. COMPLETE easy-to-follow INSTRUCTION SHEET gives you all the knowledge you need.

This Kit INCLUDES SOUND, all component parts, and the following:—

1. **Specially designed Television Antenna.**
2. **A $30.00 Brilliant Lectrovision seven-inch Picture Tube . . . plus ALL other tubes.**
3. **Pre-tuned R-F unit.**
4. **Finished front panel.**
5. **All solder, wire and 60 feet of low loss lead-in cable.**

Operates on 110V.; 50-60 cycles A.C.

Price: complete with ALL tubes, $159.50. Shipment will be made immediately after receipt of order. $25.00 deposit required on all orders, balance C.O.D.

We believe that the comparative quality of this set is superior to other available sets. It has been acclaimed by major television schools throughout the country.

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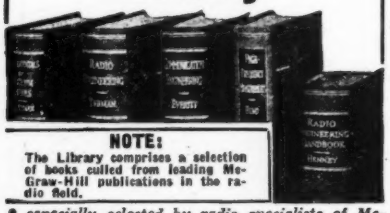

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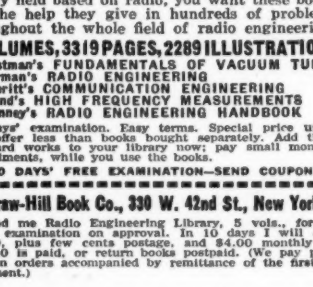

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BOOK REVIEWS

RADIO OPERATING QUESTIONS AND ANSWERS, by Arthur R. Nilson and J. L. Hornung, Eighth Edition. Published by McGraw-Hill Book Co. Stiff cloth covers, 5 x 8 inches, 434 pages. Price $3.50.

The new edition of this standard work supplies specimen answers to questions asked in U. S. Government radio operator examinations, as did the former editions. There are three appendices, covering radio abbreviations, radio regulations, radio laws, and—a new feature in this issue—the American Standards Association's authorized graphical symbols for radio and electronic equipment. All schematics in the book have been redrawn to conform to the new A.S.A. radio-electronic symbols.

ATOM SMASHERS, A Story of Discovery, by Raymond Francis Yates. Published by Didier. Stiff cloth covers, 5½ x 8½ inches, 182 pages. Price $2.00.

A story of man's exploration of the atom, written in the most popular style, this narrative begins with Democritus and continues to the experiment at Los Alamos.

The style is one that will be appreciated by juvenile readers as well as adults. Several highly scientific pieces of apparatus, such as the Wilson cloud chamber and the cyclotron, are so easily described that the reader not only understands them, but fails to realize that the subject is difficult.

The book is illustrated with numbers of good photographs and drawings, well placed to explain the subject.

ESTABLISHING AND OPERATING AN ELECTRICAL APPLIANCE AND RADIO SHOP. Prepared by Donald S. Parris and Associates, under the direction of H. B. McCoy, United States Department of Commerce. Published by the Superintendent of Documents, Government Printing Office. Paper covers, 6 x 9 inches, 199 pages. Price 35 cents.

This is one of a series of small business manuals prepared for the use of veterans and former employees of wartime civilian organizations. It assumes that the reader is already a skilled radioman and does not concern itself with purely technical features of maintenance and servicing. The 19 chapters range from selecting a location to credit management and the special problems of expansion. Coverage of all angles of the small radio business is so complete that the established as well as the beginning radio dealer or serviceman might well make use of the book, with profit to himself.

SELECTING AND OPERATING A BUSINESS OF YOUR OWN, by Gustav E. Larson, Robert H. Johnson, and Walter Magnus Teller. Published by Prentice-Hall, Inc. Stiff cloth covers, 6 x 8½ inches, 364 pages. Price $3.00.

While only 9 pages of the book directly concern the man who plans to start an electrical appliance and radio repair shop, the radio repairman or would-be radio repairman may well find interesting the three chapters on small business in general. It is also interesting to compare the prospects and problems of other small businesses with those of radio repairing.

The space given to starting an electrical and radio business is so small that the treatment is necessarily rather general, but some specific cost estimates are given. The bibliography is interesting, as it must have been made up by compiling the books on the author's desk at the moment. Three magazines are mentioned, but all are largely concerned with appliances rather than radio servicing.

(Continued on page 96)

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MULTIVIBRATORS

(Continued from page 58)

through RP2. At the instant V1 is triggered by a negative pulse, V2 grid is driven positive. V2, of course, conducts heavily, and C discharges through the low-impedance plate-cathode path of V2. This voltage change occurs rapidly, depending on C and V2's plate impedance.

There are numerous other practical applications to which the multivibrator circuit may be adapted. No attempt has been made to describe all of them.

BOOK REVIEWS

(Continued from page 95)

MOST-OFTEN-NEEDED 1946 RADIO DIAGRAMS and Servicing Information, by M. N. Beitman. Published by Supreme Publications. Heavy paper covers, 8 x 10½ inches, 192 pages. Price $2.00.

More than 300 schematics of 1946 model receivers are printed in this book. Many of the diagrams are accompanied by complete service and alignment data. In some cases parts lists and replacement data are given, and there is also a certain amount of information on record changers.

The book is carefully compiled, and in spite of the large amount of material, excellent utilization of available space has made it possible to print all the diagrams large enough to be easily read in practically all cases.

INSTALL A WAVE TRAP!

(Continued from page 87)

R.d.f. beacon signals leaking through the i.f. of the set are not the only headaches encountered in the way of interference of this type in sets with no preselection before the mixer stage. In the "good old days" of ham radio operation on the 160-meter band, some owners of small, and not-so-small, radios got very wrathful with the unfortunate amateur whose signals the second harmonic of his receiver local oscillator were converting to the i.f. of his set, with the result that several favorite programs were completely spoiled by strong "Ham chatter." Now that the 160-meter band and adjacent frequencies are being used for *LORAN* and local police radio services, the interference in most localities hasn't let up much.

This type of interference calls for almost the same treatment as the i.f. leak-through type. The only difference is that this new interference is of a higher frequency and calls for a wave trap tuned to that frequency and efficient enough to reduce the unwanted incoming signal to a level that will not be amplified by the i.f. amplifier of the set. In addition, see that the grid circuit of the mixer stage from the wave trap to the grid of the tube is sufficiently shielded.

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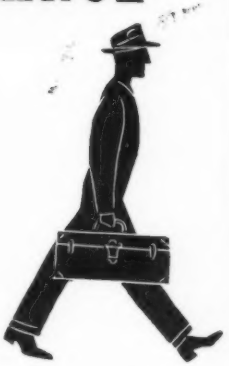
IN RADIO MAINTENANCE

June Issue

Test Equipment Maintenance

The first of a series of three big articles on maintaining your own test equipment. Every Serviceman knows the importance of keeping his test instruments properly calibrated and in good condition—and this series of articles will help you do just that. Read about preventive maintenance on Tube Testers, VTVM, Oscillographs, Multimeters, Signal Generators, etc. . . . How often they should be calibrated . . . How to service them and the equipment needed for best results . . . A discussion of laboratory techniques of fine adjustments . . . Hints and kinks . . . meter peculiarities . . . Replacement parts, etc. Your test instruments can mean the difference between success and failure of your business . . . This series of articles will be a valuable reference for your service library!



Television Receivers

Part of a series by Morton Scheraga, Television Editor for RADIO MAINTENANCE. Mr. Scheraga describes completely each of the sections in a television receiver and its component parts . . . Alignment, Maintenance and Repair are thoroughly covered . . . In Metropolitan areas, television receivers are already in wide use and smaller communities will soon have them. The public will demand competent repair and maintenance of these new sets, and the Serviceman who knows his television is assured a successful career. Follow television in RADIO MAINTENANCE and be prepared!

When the customer isn't right!

What to do to keep good customer relations. Have you ever had a customer say that your price is too high compared to others? Or that this repair job should be free because you fixed the same radio only a month previously? Find out how some of the leading servicemen in the country handle these difficult situations brought on by some customers. The most frequently encountered problems of customer relations were boiled down into ten questions and each is answered by a different service organization. Read these answers in the June issue, and they will help you meet awkward problems with tact and assurance, and keep all of your customers happy!

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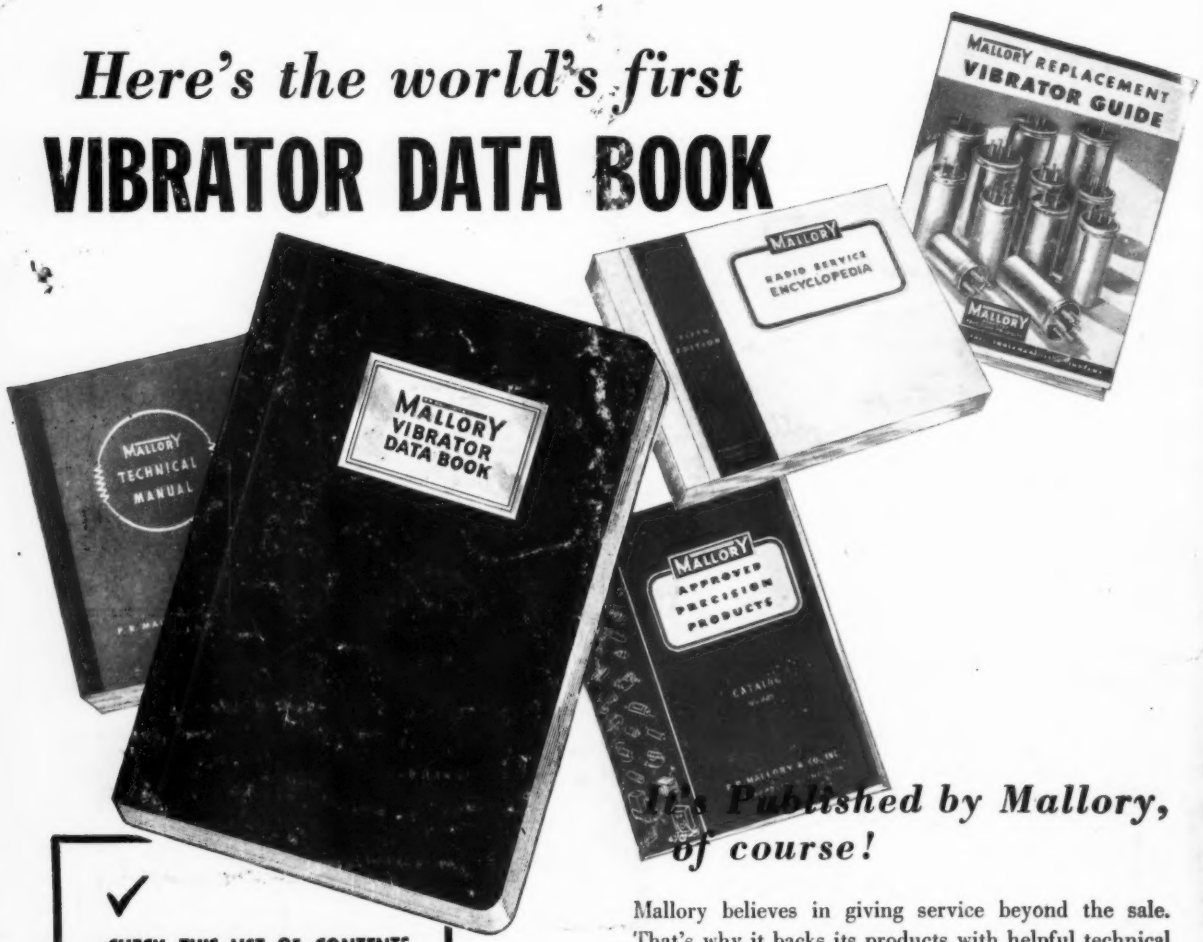

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